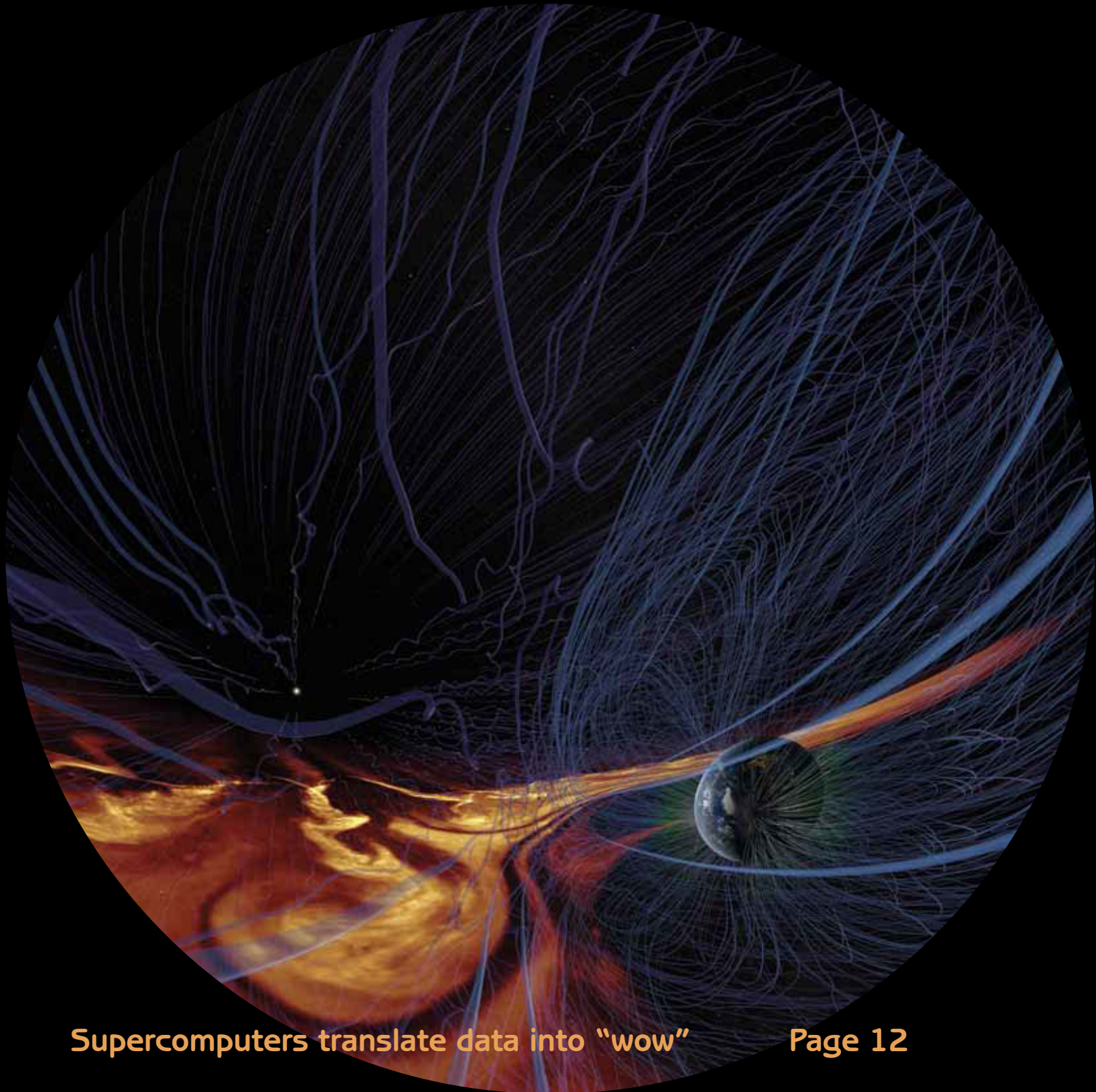


Vol. 44, No. 1

March 2015

PLANETARIAN

Journal of the International Planetarium Society



Supercomputers translate data into "wow"

Page 12

Rebirth of a Czech Jewel

Ostrava, the third largest city in the Czech Republic, lies in the eastern part of the country, near the border with Poland. Once known primarily as a coal mining and heavy industry city, it now proudly offers new opportunities in the arts, culture, music, and education, including the VSB Technical University and its planetarium.

Opened in 1980, it is now named for the famous Czech astronomer Johann Palisa, who discovered more than 122 asteroids in the early 1900's. The entire planetarium building has recently undergone a total to-the-walls renovation and has re-emerged as a true jewel of astronomy and science education. Exhibits on astronomy, astronautics, physics, geology and seismology join a beautiful observatory which is also open to the public.

About the planetarium's new GOTO INC projection system, Tomas Graf, scientific manager of the renovation project said, "The HYBRID planetarium allows us to satisfy the interest of many people, not only pupils and students from all kinds of schools but also the general public, parents, young children and even amateur and professional astronomers, who would appreciate an authentic image of the night sky." Graf even utilizes the system in popular programs featuring jazz, classical, and relaxation music.

The essential, authentic sky image is provided by the GOTO PANDIA HYBRID system. The GOTO PANDIA produces a spectacular sky from a tiny starball only 48 cm in diameter. It shines 8,500 brilliant stars onto the 13 meter dome, along with hundreds of deep sky objects and a 40,000,000 micro-star Milky Way. A full-dome video system from EVANS & SUTHERLAND is seamlessly linked and synchronized with the PANDIA through GOTO's unique HYBRID software and manual control console.

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The visualization of a scientific numerical model reveals a turbulent front generated by a solar wind interacting with Earth's magnetic field during a powerful solar storm. Large disturbances, including high velocity jets, can penetrate deep inside the Earth's magnetosphere and result in space weather effects such as loss of communications satellites and widespread blackouts. Numerical simulation by Homa Karimabadi, Mahidhar Tatineni and Vadim Roytershteyn, University of California, San Diego. Visualization by the Advanced Visualization Lab (Donna Cox, Robert Patterson, Stuart Levy, AJ Christensen, Kalina Borkiewicz, Jeff Carpenter) at the National Center for Supercomputing Applications, University of Illinois. Funded in part by the National Science Foundation.

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Breaking news: New venue for 2018 Conference is needed

I want to make you aware of an important issue regarding the status of the IPS 2018 Conference. The Clark Planetarium in Salt Lake City, Utah informed us that for reasons beyond their control, they must withdraw their bid to host the IPS 2018 Conference.

Of course, this is very sad news since they were the only bidder to host that conference.

The good news is that we have the opportunity to open the bid process once again. In 2014 our conference was held in Asia and in 2016 we will be in Europe. Where on our lovely blue planet shall we meet in 2018?

The IPS Council is working on securing bids for a new conference site.

Watch the website for further developments and information about potential sites. A decision will be made by IPS Council in August of this year.

Joanne Young
IPS President

In Front of the Console

Sharon Shanks, Editor

What a stunning cover for this issue! The featured image led to a flurry of last-minute activity when I asked if another image could be produced that showed what the raw data looks like before it becomes eye candy in our domes.

Many thanks to Donna Cox from the National Center for Supercomputing Applications at the University of Illinois for making this request possible, and also to Kalina Borkiewicz, who sent image after image, each

one cooler than the last.

The images, along with Judith Rubin's story about how numerical data wound up in a new fulldome program, also led to the decision to follow up on scientific visualization in the June *Planetarian*.

I don't know how many of you reading this are like me, in that I know that rather boring numerical astronomical data is being visualized at places like the NCSA and incorporated into fulldome programs, but have no idea of

Letters to the Editor

Response to review of *Impact Craters of Earth*

Much of the review of my newest book, *Impact Craters of Earth*, (*Planetarian*, Vol. 43, No. 4, page 42) seems to miss the point. The comment that referring to NiFe meteorites as siderolites is obsolete terminology is dubious. A Google search taking just 0.33 second turns up 19,200 entries for siderolites, so if I'm obsolete, I have plenty of company.

But, the book is about craters, not types of meteorites. To harp on a brief mention is much like the *New York Times* denouncing Robert Goddard's 69-page pamphlet on using rockets to study high altitude meteorology for a brief six lines on page 68 regarding the possibility of sending rockets to the Moon.¹

As for the Azuara and Robielos de la Cerida craters, such standard sources as Jarmo Moilanen's *Impact Structures of the World* and Russia's *Expert Database on Earth Impact Structures*² both list these as craters. One might also look at the several articles by Ernstson³

and colleagues on Azuara (1985, 1990, 1992, 2001, 2002) reporting studies of these craters, and describing suevite and other geology unique to craters.

The review fails to mention that the book gives directions on how to visit every accessible crater, towns located in craters, and a table showing a comparison of the number of craters per million square miles for each continent and for the moon. That last is to the best of my knowledge a unique offering.

Earth does offer a number of vaguely circular or arcuate features which at one time or another have been suggested as craters. In North America alone we have Hudson Bay, the Gulf of Mexico and the coast lines of the Carolinas. However, there is absolutely no evidence even hinting at an impact origin for these, so they are not included.

Thomas Wm. Hamilton
HOSS Planetarium, New York

ogie, 581-589; Ernstson and Fiebag, 1992, "Azuara Impact Structure: New Insights from geophysical and geological investigations," *International Journal of Earth Science* 81 (2), 403-427; Ernstson, Rampino and Hiltl, 2001, "Cratered Cobbles in Triassic Northeast Spain," *Geology* 29, 11-14; Ernstson, Claudin, Schuessler, Hradil, 2002, "Azuara and Rubielos: Paired Impact Structures," *Museum of Geology, Barcelona*, 11, 5-65

the process needed to get it there.

When audience members would ask me what the data looked like, I was content to say "numbers. All numbers." I'm not content with that answer anymore, and I mean to bring a better answer to *Planetarian* readers as well.

Isabella Beyer, in her article starting on page 22, points out that people can still think that we show them real stars on our domes, and we must take care to guide them into the proper intellectual mindset when producing our programs.

Along with the problem of fake vs real stars, how many people in our audiences also think that the beautiful images from the Hubble, Chandra, and Spitzer telescopes are taken the same way they click a selfie? My guess is "many."

Mark SubbaRao and his Science & Data Visualization Task Force have been working on educating us, but I've always felt a disconnect between what he's been writing in his Data to Dome column and my daily job, and it's my fault: I never thought about the transition between the data and the images.

I was stuck in the same rut as most of our audience members: that astronomers are like the iconic picture of Edwin Hubble sitting alone at the eyepiece of a giant telescope.

In reality, astronomy is done by teams of people spread across the country and the globe who probably never see the telescope doing the observing/data collection for them.

Their data is no longer on photographic plates, but buried in numbers, arranged in thousands of rows across hundreds of columns on a spread sheet. The trick is to mine the data for information and then output it in an understandable format.

To be effective educators and purveyors of astronomy to the general public, we need to know the entire process and make sense of it. "Data to dome" is something that most planetarians are ignoring, and they should not be.

The data in the dome is immersive and 3 dimensional, and if planetariums don't appreciate the visuals that come out of the data, then how can they share its importance with the public?

Welcome

Please welcome several new faces to the *Planetarian* pages starting this issue.

Carolyn Collins Petersen has taken over the job of keeping us informed about the immersive media world.

Lars Petersen has done a great job transitioning into compiling the International News, taking over from Lars Broman.

And Chuck Rau from Seiler Instruments' Planetarium Division is sharing his talents with a new planetarium-related comic called "Bard Spiral."

We're glad you've joined the family. ☆

¹ *New York Times*, January 19, 1920, unsigned editorial
² Both of these publications, including an English language version of the Russian database, are available on line

³ Ernstson, Hammann, Fiebag, Graup, 1985, "Evidence of an Impact Origin for the Azuara Structure," *Earth and Planetary Science Letters*, 74:361-370; Ernstson and Claudin, 1990, "Ejecta of the Azuara Impact Structure," *Nachrichten der Jahrbuch von Geol. Palaeontol-*



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Dear Fellow IPS Members,

It gives me great delight to be working with you and for you as your new president. What a great honor it is to take an active role in the transformation of IPS to meet the challenges of the future.

Our challenge as planetarians is to develop the planetarium to take a leading role in scientific and educational communities. Imagine a future when planetarium theaters are required and are always funded and never closed except to build a new one.

Our challenge as IPS is to equip you to do your job successfully.

The vehicle to fulfill our role is through Vision 2020. The direction of Vision 2020 was developed by and for you through the IPS SWOT survey, which many of you completed. We are grateful for your participation.

You pointed out our weaknesses, and strengths, with suggestions for a globally-productive future for our organization. The Vision 2020 Team, the officers and committees are operating at a rapid pace to provide the essential programs, papers, research and conferences that will give you the tools, knowledge and skills to perform your jobs exceedingly well.

By the time you read this message, my fellow awesome officers, Thomas Kraupe, Lee Ann Hennig, Shawn Laatsch, Ann Bragg, and our fearless Vision 2020 leader, Jon Elvert, will have met at my house on Florida's Space Coast to work out the details of our ongoing projects. I will report the results of that meeting in the next issue of *Planetarian*.

In the meantime, you can get an idea of the issues we are facing in Jon's update that follows on this page.

Additionally, the officers and I are working with Maciej Ligowski and Monika Malinowska of the Copernicus Science Centre on IPS 2016 in Warsaw, Poland. We are thrilled with Maciej's and Monica's plans for an extraordinary and enriching conference.

I think you will agree, after reading their report in this issue, that IPS 2016 will be an essential conference for your development as a planetarian. You won't want to miss it.

If you feel the call to contribute your skills, ideas, and time to our great cause, we welcome you with open arms. Join a committee

or Council, run for office, assist in a project, host a conference. Our success will be the result of exciting collaboration among dedicated and knowledgeable planetarians.

We're in this together!



Vision 2020 Initiative update

By Jon Elvert, Chair
Vision 2020 Initiative

A final strategic planning document that provides guidance and opportunity to meet changing needs and challenges, as well as providing better support to its membership in every region around the world, has been approved by IPS Officers and posted on our web site.

This IPS Vision 2020 Strategic Planning document was translated into five languages: Spanish, Chinese, Japanese, Russian, and Korean, and posted in their entirety at www.ips-planetarium.org/?page=vision2020.



These translations were sent to their respective IPS representative with the intention of being further distributed to regional planetarians (the Korean document was sent directly to all known planetariums in South Korea). The English version was sent to all other representatives.

This was done to gather additional input, especially from our international representatives.

Vision 2020 SWOT Survey Update: The IPS web site hosted a survey to gather your responses to questions relating to the Strengths, Weaknesses, Opportunities, Threats (SWOT) of IPS. The web site survey was active for five months before ending on 31 December.

In addition to the survey, SWOT analysis presentations were given at several affiliate conferences. To date, nearly 600 responses from the survey have been recorded, taken by 274 participants representing 20 countries (not including conference participants).

Although the survey is no longer active on the IPS web site, it is still possible for more of our international colleagues to make their views heard, especially those who do not have reliable internet access.

Please complete the survey and return it to us by mail, or send it to your affiliate representative to pass along to IPS Vision 2020 committee.

The following is a summary of the most recent themes from each SWOT category:

Strengths:

- IPS is a global community of diverse cultures
- Regional affiliate representation
- History of organization
- Inclusive of fixed and portable planetariums
- Provides educational resources; web site and journal
- Beneficial conferences

Weaknesses:

- Bureaucratic organization; outdated governing documents
- Council and officer Term limits; volunteerism vs. paid position
- Concern for costs-membership and conferences
- Slow in attracting next generation of planetarians
- General apathy of membership, council
- Discrepancies between small and large planetariums

Opportunities:

- Develop strategies for sustainable growth-attendance, revenue, value, influence, membership
- Establish connections with other dome-related professional organizations and professional partnerships
- Become more professional; grow up; hire full-time organizer; re-image IPS; define a future
- Equalize planetarium technologies and planetarium/astronomy education
- Recruit or foster new members; provide professional development in-services; share resources
- Implement social media more effectively; web site under utilized
- Make council more accountable to its members, redefine responsibilities for council members

Threats:

- Other competing fulldome organizations
- IPS' stagnant organization; failure to act; becoming irrelevant
- Two class membership ("haves and have nots"); membership dues too expensive
- Apathy-both within IPS (little interest in candidates for council) and without (attracting new members)
- Failure to see future and implement changes

(Continues on page 29)

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March 2015

Planetarian

7



Past President's Message

Dave Weinrich
Retired

Planetarium, Minnesota State University-Moorhead
Moorhead, Minnesota 56563 USA

dave.l.weinrich@gmail.com

Presented to the IPS Council at 2014 Beijing Conference

This year marks not only my retirement as an IPS officer, but also my retirement as the planetarium director at Minnesota State University Moorhead (Minnesota). As one chapter of my life draws to a close, another opens. I have many new and exciting projects and possibilities to look forward to, thanks in large measure to the opportunities that being an officer of this organization has provided me.

But first I must digress, back to the beginning of my involvement in a leadership role in our society, when I was elected in 2005 to the position of Great Lakes Planetarium Association (GLPA) representative to the IPS Council.

The International Planetarium Society is a federation of 22 member affiliates. Our organization is governed by the IPS Council, which consists of the 22 affiliate representatives and five officers. I hope that all of you realize the importance of your affiliate representative and the service that they provide to both your member society and to IPS.

When I was elected as the GLPA representative, I had no idea where the role would lead me or of the possibilities that it would present. I did know that I strongly believed in the importance of my local affiliate and of IPS.

Found warmth and acceptance

At my first Council meeting in Melbourne, Australia in July 2006, I was struck by the warmth and acceptance of the entire Council, and most particularly by the officers—President Martin George, Past President Jon Elvert, President Elect Susan Button, Secretary Lee Ann Hennig, and Treasurer and Membership Chair Shawn Laatsch. I must make special mention of Lee Ann's personal warmth and how she totally made me feel at ease and a part of the Council family.

It has been a privilege to serve with a variety of officers over the years, but Shawn and Lee Ann are like the rocks and we presidents are the stream passing by. They have been a solid backbone for the Society for almost two decades. I thank my fellow officers, and don't think that the general membership or even

the Council recognizes the number of hours that the officers serve IPS. Most of this work goes on behind the scenes, week after week, month after month, and year after year. All of it is voluntary. Let's all recognize my fellow officers with a round of applause.

A privilege to serve

It has been a privilege to serve you all. When I was nominated to stand for election as president elect, I reflected on the fact that I had been a member of IPS for 25 years. I had received many benefits and now might have an opportunity to give something back. Our organization has many members, and some of us must take on the work that is necessary to run it or the society cannot not continue.

I was willing to stand for election, knowing that it would only be for six years and that there would be many people to help with the task. That has been true and I sincerely thank all of you that have encouraged and assisted me in so many ways.

There are two events that especially stand out during our (the Council and my) journey together over the last five years.

In 2011, Council met in Nizhny Novgorod, Russia. I wanted to strengthen our relationship with the Russian affiliate and to let them know that they are a valued part of our Society. I worked with Alexander Serber at the Nizhny Novgorod Planetarium and my fellow IPS officers to plan the meeting.

Finally, the date of the Council meeting arrived and after months of preparation, I was waiting at the hotel for the last Council members to arrive. When the bus from the airport arrived late that night, I was so happy. Now, I could relax. Our Council family had safely gathered together once again. We had a very productive meeting.

I don't think that any of the Council members who were in attendance will forget the final evening's sendoff

at a local karaoke restaurant. We all sang together and it truly didn't matter what our nationalities were or whether we could speak each other's languages. We were all planetarians with the goal of communicating our love of the universe to our audiences. At that moment, I felt connected to the entire planetarium community around the world.

Another highlight was the 2012 conference that I presided over in Baton Rouge, Louisiana. While it was the largest conference ever, it ran so smoothly, thanks to the tremendous work of Jon Elvert, the staff of the Louisiana Art and Science Museum, and the wonderful team that they assembled. Although my duties as president prevented me from attending as many paper sessions as I might have wished, I did derive great pleasure from seeing the joy of the conference attendees.

We have so many good ideas

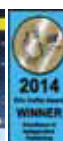
One thing that I have observed, over my past six years as an officer, is the incredible number and variety of good ideas that planetarians share with each other. I especially appreciate younger planetarians with their energy and enthusiasm and their great new ideas. We older planetarians (I'll let you determine which group you fall into) can regain, if necessary, some of that enthusiasm which we may have lost by visiting with and listening to younger colleagues.

All of us, whether young or old, can mentor newer members of our profession. There are opportunities for us to work together to improve our profession and the presentations that we offer our audiences.

I am making some final edits on this report in Hong Kong, where I am going to be visiting some local planetariums and astronomy-related facilities.

Even though my service as an officer of IPS has finished, I will still continue to be involved in the Society and to visit some of you during my travels.

Being an officer of the Society is a lot of work, but don't imagine that I haven't received benefits as well. I have and I will always value the privilege that it has been to serve all of you. ☆



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"Sweet Sixteen" is fast approaching

By the Staff of the
Copernicus Science Centre
Warsaw, Poland
planetarium@kopernik.org.pl

IPS2016 is coming upon us fast! Even though 2015 is a year without an IPS conference, for us IPS2016 is already a topic that figures prominently in our day-to-day work. And because we are preparing this whole conference with you in mind, we have decided to share a couple of pieces of recent news.

As you will recall, right after the end of IPS2014 we launched a questionnaire-based survey among planetarium representatives. We wanted to get to know the specifics of how you work and what expectations you have with respect to the conference.

Before presenting the results, we would like to take the opportunity to thank all of those who shared their opinions with us. They are serving us as a foundation to build the conference programme, and they have turned out to be a real treasure-trove of ideas for how to make the conference more attractive. Have a look for yourself!

Live shows still prominent

Your responses to the question about the typical show scheme indicate that despite further advancements in fulldome technology and the increasing numbers of fulldome shows on offer, a clear majority of you do still have live shows among your repertoires.

The largest share of planetariums surveyed (42%) harness the whole potential of modern systems, presenting a mixture of both live shows and fulldome shows.

Smaller percentages of planetariums mainly present typical starball shows (27%), lectures (18%), or live shows (9%).

Interestingly, just 4% of the institutions surveyed exclusively present fulldome shows.

As far as show themes are concerned, astronomy is clearly dominant (53%) over popular-science themed (30%) and entertainment shows (17%).

In addition to the standard repertoire, most of you (93%) also engage in other types of activity under your domes: public telescope viewing (31%), night sky observations (23%), workshops (20%), and VIP lectures (19%).

As to the conference itself, your survey responses indicate that the aspects you find most important are opportunities for networking (with 542 points out of 670 possible) and the chance to take part in nonstandard events and activities (493/670).

Wanted: workshops, live shows

You expect the talks to be high-calibre and substantive. Based on experiences from previous conferences, we can conclude that you are most impressed by the workshops (490/670) and live shows (489/670).

Lower on the list are exhibitors and the dome village (429/670) and the vendors' presentations (422/670).

Your responses to the open question about topics you would like to see addressed at IPS2016 indicate that they concern the broadest possible spectrum of planetarium activity, including show content, show creation and delivery techniques, personal development, operations and management, accessibility, and data access.

You have also called attention to diversity and the differing profiles of planetariums, based on size, target group, and form of activity.

Some respondents also mentioned the need to initiate and foster cooperation between planetarian communities and top-notch astronomy-related institutions like the ESA, ESO, NASA, etc. There were also positive comments about the IPS satellite fulldome festival (held in Macao prior to the 2014 Conference in Beijing).

As you yourselves have expressed it, there-

fore, we know we have quite a challenge on our hands in preparing for the IPS2016 conference, and we are doing our utmost to prove ourselves up to the task! Because we like a good challenge, we are pleased that expectations for the event are so high.

Based on the responses and comments gathered, we have formulated the following priorities for the IPS2016 conference programme:

- Devoting a portion of the talks to all the myriad aspects of live shows, including, for instance, production, presentation, storytelling, personal skills.
- Maximizing the time participants spend under the dome and presenting as many of the conference materials as possible on the dome itself.
- Creating a conference program that reflects the internal diversity of the planetarium community and also the diverse range of challenges and issues that need to be tackled by planetariums (including STEAM education, data to dome transfer, and international collaboration).
- Ensuring that the programme events are of a highly substantive nature, by focusing on problem-solving, satisfying concrete needs, and looking at specific issues from various perspectives.
- Introducing interactive elements and networking during all the component parts of the conference—not only coffee breaks and lunches, but also at talks (in the form of discussions, group work, group games).

We also want to prepare a handful of surprises and additional attractions.;

Of course, we will still continue to need your help and collaboration! Without your knowledge and experience, without you taking active part in shaping the conference programme and then being present at the conference, the above priorities will never become a reality.

Please share with us any remarks, thoughts, additional ideas you may have, by writing to the address info@ips2016.org.

We also want to encourage you to think about the topics and format of the talks, because we will be gathering your proposals together already in autumn 2015.

That will ensure we have more time to put together an attractive programme and to publish a preliminary version of it prior to registration in 2016.

If you want to stay abreast of all conference news, have a look at the website www.ips2016.org. We will be gradually posting all the crucial information there, which will be successively supplemented and updated. Pay the site a visit, and don't forget to add it to your favourites!

We hope you'll join us in Warsaw and will help us make IPS2016 an unforgettable event.

See you in Warsaw in 15 months!



Visualizing the Data

It's all a part of the process: It takes billions of data points to produce a single still image or a single frame of video. For the stunning graphic of the solar superstorm particle interaction on the cover, the numerical data is transformed through supercomputers into something the human eye can understand.

In **this issue**, Judith Rubin looks at how producers are using supercomputing visualizations to explain the science in their programs. In the **next issue**, we'll look at the process of research astronomy and how those billions of data points become **data on our domes**.

Solar Superstorms:

How big data feeds a big movie

By Judith Rubin

"From our vantage point, the sun is calm and unchanging. But in fact, its surface is turbulent and chaotic, with giant waves of hot plasma and towering thunderstorm-like features," said Donna Cox, director of the Advanced Visualization Lab at the National Center for Supercomputing Applications (NCSA) in Champaign, Illinois USA.

Cox was discussing the new fulldome show *Solar Superstorms*, a collaboration with Spitz Creative Media and Thomas Lucas Productions in association with Fiske Planetarium at the University of Colorado, Boulder.

The project has been made possible with support from the Commonwealth of Pennsylvania and the Pennsylvania Film Office and funding by the National Science Foundation (NSF).

For their part, the supercomputers now being used to analyze the sun are increasingly busy.

"As supercomputer speeds have increased 100+ fold, teams of scientists generate in-

creasing volumes of numbers that reveal the hidden laws of the universe. The goal of our group is to transform this massive data into a cinematic experience that conveys the science," Cox said.

The growing complexity of scientific data sets is complemented by better rendering tools and the heightened display capability of top-line 8K fulldome systems, now accepted among the industry as good enough even to fill the place of 15/70 film. (See also **Digital Dome and Beyond** on page 34. -ed)

For the experienced production team be-

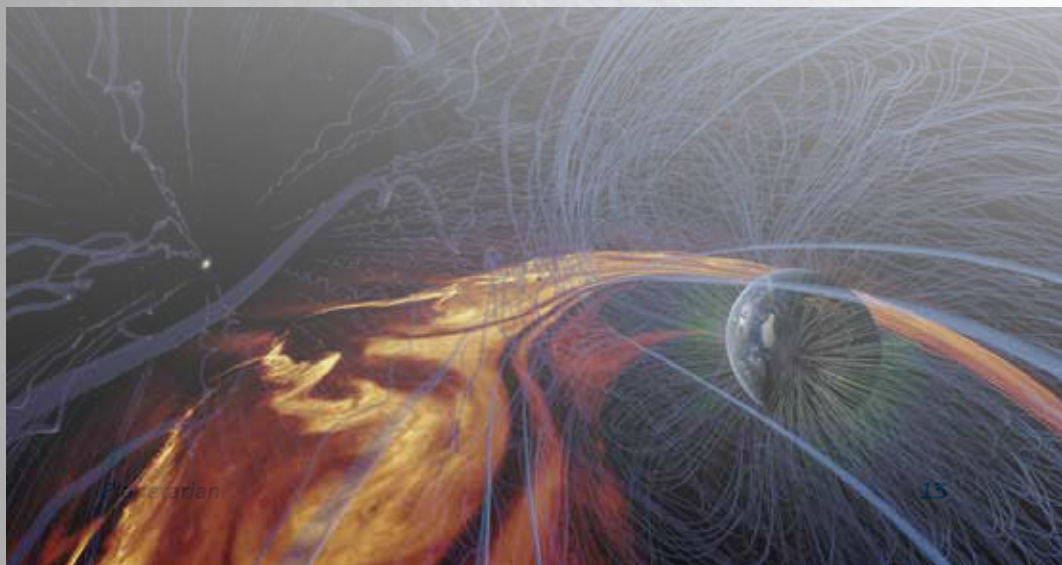
hind *Solar Superstorms*, it adds up to the ability to take audiences on a glorious, immersive cinematic tour inside the workings of the sun.

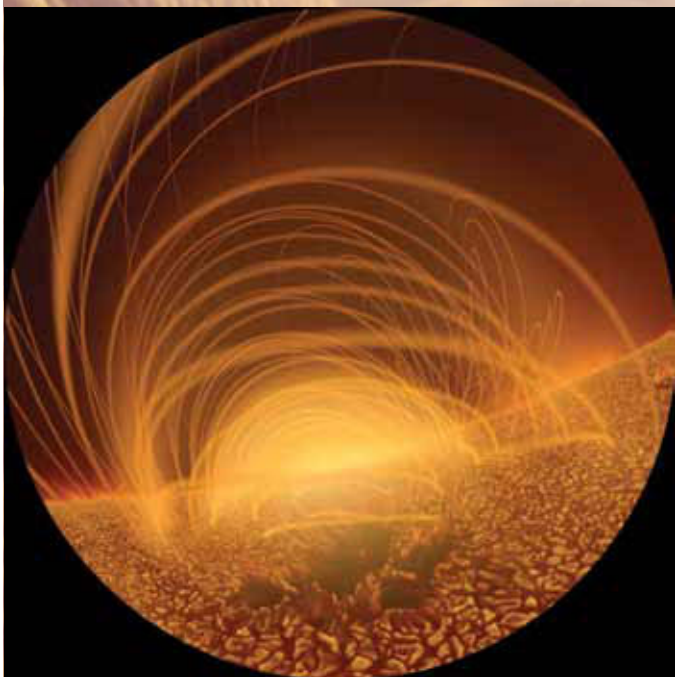
Cox described "visualizations of scientific data never seen before by the public—places invisible to telescopes, made beautiful and visceral; the dynamics of the interior of the sun, plasma, and giant coronal mass ejections.

"A lot of this cutting-edge supercomputer science will be new to the general public, in particular the story of plasma, how the sun erupts in violent storms and how they can

(Continues on next page)

Judith Rubin is a freelance journalist and publicist specializing in large format cinema. www.judithrubin.blogspot.com





Three views of the sun's violence: A coronal mass ejection in the making (top), a tangle of magnetic fields rising from a sunspot region (center), and a blast of electric current, magnetic field, and hot plasma rising from the solar surface. For all images: CME simulation by Yuhong Fan, solar surface simulation by Matthias Rempel, both from National Center for Atmospheric Research. Visualization by NCSA.



On Page 12, background and Page 13, foreground: Stages in the visualization of the cover image. Numerical simulation by Homa Karimabadi, Mahidhar Tatini and Vadim Roytershteyn, University of California, San Diego. Visualization by the Advanced Visualization Lab (Donna Cox, Robert Patterson, Stuart Levy, AJ Christensen, Kalina Borkiewicz, Jeff Carpenter) at the National Center for Supercomputing Applications, University of Illinois. Funded in part by the National Science Foundation.

affect earth's communications and power grids," she said. "The Spitz team has also generated cutting-edge animations that contextualize and amplify the scientific data."

"We were able to deliver many great moments and sequences," said *Solar Superstorms* director Thomas Lucas. "For instance, taking us onto the surface of the sun, getting close to the towering, bubbling, thunderstorm-like clouds that roil up from the surface and then slip back down, flying in among them, looking at jets of plasma shooting up from the surface..."

A sharable moment

In addition to never-before-seen solar visualizations, *Solar Superstorms* shares a story that all viewers can relate to personally. Remember the events and chain reactions that took a chunk out of Earth's communications in the feature film *Gravity*? *Solar Superstorms* shows how the natural activity of our sun could lead to an equally disruptive, real-world result, using the example of a solar eruption that penetrated Earth's atmosphere some 150 years ago.

The Carrington Event² was named after Richard Carrington, a British astronomer who observed and documented it. Even in a much simpler world, connectivity was affected.

"The great solar storm of 1859 produced an auroral light show not to be believed, but it also knocked out telegraph systems," said Lucas. "We have much more to lose today." *Solar Superstorms* illustrates the event and documents how scientists are studying ways to understand and detect a similar event.

Live action and special effects are part of the cinematic mix and facilitate the storytelling. The Spitz team, interested in experimenting with and developing techniques for live-action gigapixel photography, went on location to the Rocky Mountains, where the Carrington Event had been witnessed by a Denver newspaper reporter.

"The live action sequences lead audiences to a more direct experience of the subject matter," said Lucas. "We knew we could get a lot of vertical dimension to imagery that would work well on the dome: the sky, characters in the foreground, amazing vistas, trees. We worked out scenes, then reconvened in Philadelphia in a green-screen studio to shoot the

¹ *Gravity* is a 2013 science fiction thriller film directed and produced by Alfonso Cuarón. It stars Sandra Bullock and George Clooney as astronauts, and sees them stranded in space after the mid-orbit destruction of their space shuttle and their subsequent attempt to return to Earth. Source: en.wikipedia.org/wiki/Gravity_%28film%29.

² You can learn more about the Carrington event at news.nationalgeographic.com/news/2011/03/110302-solar-flares-sun-storms-earth-danger-carrington-event-science, and en.wikipedia.org/wiki/Solar_storm_of_1859.

live action characters. It is this kind of intensive collaboration that I find to be the most rewarding about dome production,” said Lucas.

In collaborating with NCSA, “We explore the conditions within the sun needed to trigger these really massive blasts that lead to something like the Carrington Event,” said Lucas. “In all that huge complexity of data, we must pull out some simplicity to tell the story while giving a sense of how complex it really is.”

The NSF grant and CADENS

Using supercomputers to simulate natural events is rapidly changing the way science is being done, and behind the visualizations are some of the best peer-reviewed scientific discoveries being shared today.

One of the goals of NCSA and the *Solar Superstorms* team is to help create greater awareness among viewers about the growing role of computational science.

“The huge supercomputers are our new disaster forecasters,” said Cox, “and data is the new digital fuel for visualization studies of natural phenomena. But in testing fulldome audiences—which we did when we developed one of our previous shows, *Black Holes: The Other Side of Infinity*—it became very clear most general audiences do not understand scientific visualization, nor how computational science affects their everyday lives in such things.”

Very few places beyond NASA Goddard and NCSA have the resources available to transform big data into cinematic expression. “When you’re talking about multiple terabytes per science project and more than five of these data-driven scenes used in *Solar Superstorms* alone, that is a big challenge that almost no production house or museum can handle,” said Cox. “And very few big data visualization teams are focused on public outreach.”

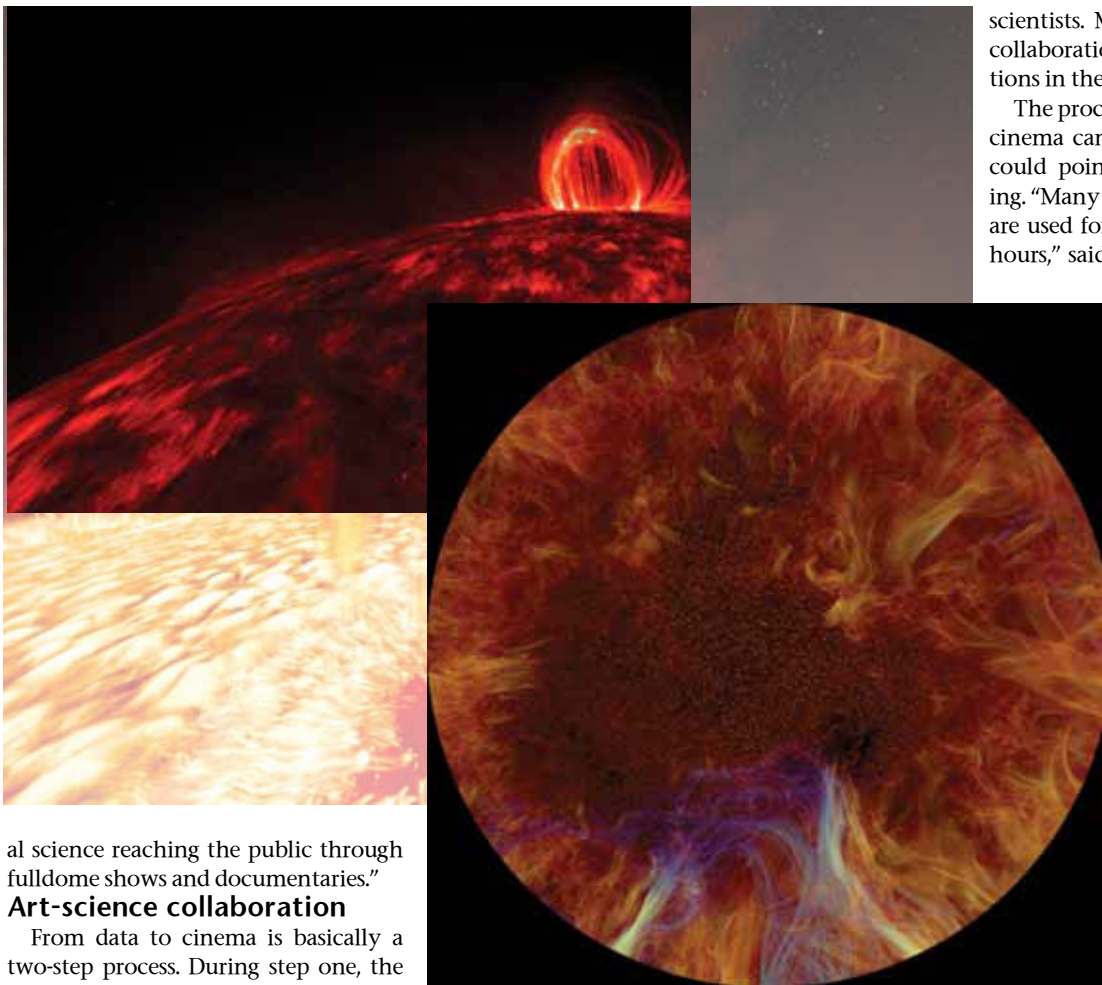
In a notable step forward, NSF recently awarded a \$1.5 million grant to CADENS (Centrality of Advanced Digitally ENabled Science), an NCSA-led initiative led by Cox to develop and widely distribute a series of science documentaries highlighting visualizations of computational and digitally-enabled science.

Solar Superstorms is the first production to receive funding from the grant, but the CADENS award, which assembles producers, technologists, artists, and educators to collaborate with scientists and researchers, is significant for the entire fulldome community.

“There is definitely an increase on the part of operators, producers and distributors to include this kind of high-level computational science in fulldome shows,” said Cox, “and part of the mission of the CADENS award is to raise awareness and facilitate computation-
(Continues on next page)



Top: Astronauts on-board the International Space Station look down on spectacular auroras. Next: A journalist reported auroras in the wake of the 1859 solar storm were “so bright you could read common print.” Next: Solar plasma envelops Earth in the wake of a powerful coronal mass ejection. Bottom: Tens of thousands of airline flights fill the skies each day, part of the vast power and communications network that is vulnerable to a solar superstorm. All images from Spitz Creative Media.



al science reaching the public through fulldome shows and documentaries.”

Art-science collaboration

From data to cinema is basically a two-step process. During step one, the generation of data, the science team sets up experiments in supercomputers to calculate all the physics in a 3D virtual world and generate all that data.

For step two, the generation of pictures, the production team transforms, designs and choreographs the data using custom software and animation software for rendering.

“Transforming billions and trillions of numbers into digital pictures involves artistic selectivity,” said Cox. “We have lots of choice on rendering, timing, pacing, camera choreography, and how we treat data, just as other artists make aesthetic decisions with composition and color in a variety of media.”

Walking the line between science and art to achieve authentic results involves close, extended dialog with scientists.

On the one hand: “We discuss issues of data and representation to maintain accuracy,” said Cox.

On the other: “We work with Tom Lucas and others who bring artistry and storytelling sensibility, to make sure it captivates while communicating. Tom and the scientific team have frequent conference calls to achieve a balance between being accurate while also being dramatic and memorable. There may be gaps to fill in—for instance, it is necessary to scale time or space in order to travel across the

Top: Scientists are intensively monitoring the sun with high resolution imaging from satellites, including the Solar Dynamics Observatory. NASA. Below: Loops of magnetic field rise into the hellish region just below the solar surface. Simulation by Robert Stein, Michigan State University. Magnetic field line tracing by Patrick Moran, NASA Ames Research Center. Solar surface simulation by Matthias Rempel, National Center for Atmospheric Research. Visualization by NCSA.

universe. But we remain true to the data and gather scientists’ feedback when we take artistic license.”

How do the scientists react?

“They love to see their stuff on the big screen,” said Cox. “Most of them want very much to see the work get outside of their specialized community to a broader audience, and they understand that to do so, some things need to be explained or slowed down. And they learn about storytelling from us. Working with scientists has been positive for us.”

Does this process affect the scientists’ approach? “Yes,” said Cox. “They often see new things in the visualizations and gain new perspectives of their science. The process of rendering an animation will sometimes bring new things to light and prompt them to research in a new area. For example, in one project the visualization revealed the existence of a secondary tornado in the data not seen by

scientists. More than once, these art-science collaborations have influenced new directions in the research.”

The process also underscores how fulldome cinema can become a tool of scientists, and could point to sources of additional funding. “Many of these domes, smaller and larger, are used for science visualizations during off hours,” said Cox. “Some domes are being explored as telescopes into scientific data.”

Science journalism

“Fulldome is a natural way to view this very large big data because it is immersive, and we can bring the audiences on a virtual tour through this phenomena,” says Cox.

“It’s a unique way of telling the story, and it supports a variety of approaches. It’s just wonderful to work with people like Tom Lucas, Mike Bruno and the team at Spitz—we’re a very complementary and synergistic. Lucas is not only able to bring together the story from the scientific point of view, but also support it with graphics and animation so that it unfolds for the audience in a natural, interesting way.”

“One thing we find with dome audiences is that they really want to know. They are prepared to watch and listen closely, with singular, focused attention,” said Lucas. “Their expectations for the experience are high. The unique as-

pects of dome production allow us to really deliver it, and to do so with increasingly higher production values. We have the means to create a high-quality, educational show that is about the world people live in, conveys understanding, and gives a thrill ride. It’s become our formula for success. It’s a bit journalistic—not fantasy or narrative, but topical—exploring something people are curious about, and telling the stories behind the stories.”

The team and scientists at UC Boulder have taken an active role in the production of *Solar Superstorms*, being involved in script review, fact-checking, and other aspects, as well as hosting rough cut screenings, performing audience evaluations to feed back into the final product, and creating educational outreach materials to support the show.

The 24-minute show is scheduled for release in spring 2015 and will be available in 4K 2D, with 5.1 or stereo soundtrack. For licensing information, contact Mike Bruno at mbruno@spitzinc.com, or +1 610-459-5200. ☆

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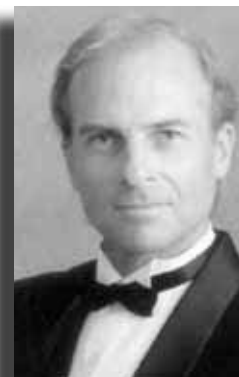
To watch the trailer and for information on ordering the show, visit www.calacademy.org/licensing or contact your local distributor.

This program is funded in part by the Gordon and Betty Moore Foundation.



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The Logic of SETI: 20 years later “Where do we go from here?”



Dr. Michael Chauvin
Honolulu, Hawaii USA

STRANGERS¹

*“I see nobody on the road,” said Alice.
“I only wish I had such eyes,” the King
remarked... “To be able to see Nobody! And at that
distance too!”*

*Lewis Carroll, Through the Looking-Glass
(1871)*

Human interest in the possible existence of extraterrestrial intelligence must be as aged and inveterate as terrestrial intelligence itself. Metrodorus of Chios, the Greek philosopher and disciple of Democritus, thought it absurd to consider the Earth the only populated world, and Lucretius, the Roman poet-philosopher, argued that because nothing in the Universe is the only one of its kind, it seems reasonable to suppose that there are other, Earth-like worlds elsewhere, inhabited by a varied assortment of men and beasts.

The infamous death-at-the-stake of Giordano Bruno terminated but one man’s speculations on the plurality of worlds, and several centuries after his fiery immolation at the hands of the Inquisition in the year 1600, conjecture upon those worlds—and upon the alien life forms that might inhabit them—continues with unabated passion.

The spying upon those worlds by Earthly telescopes has only added to the excitement, and even as the 20th century drew to a close and the 21st began, the clamor had not subsided.

Witness the following episodes, all of recent vintage:

- the establishment, in 1980, of the Planetary Society by SETI advocate Carl Sagan;
- the acclaim garnered by Sagan’s Emmy Award-winning *Cosmos* television series and its re-make by Neil Tyson in 2014;
- the box-office success of the *Star Wars* movie trilogy;
- the publication, by the oldest printing and publishing house in the world, of four scholarly books on the history of the extraterrestrial life debate;²
- the investment in SETI programs of large sums from both private and public purses (the NASA purse contributing millions of dollars during the 1980s alone);
- the establishment, in 1994, of the SETI League;
- the public hullabaloo caused by the bold proclamation, in 1996, that the planet Mars might have a fossil record;³

- the more recent discovery by the Kepler space telescope of a multitude of exoplanets, some of them possessing “Goldilocks” attributes;
- the coming-of-age of the new scientific hybrid called astrobiology; and, since 1999,
- the ever-widening public participation, via personal computers, in SETI efforts.⁴ All are testament to the abiding lure of the prospects of alien life.⁵

It is when such an interest in extraterrestrials—real or imagined—by scientists, theatergoers, politicians, and the general public becomes feverish that an antidote is needed and that some sobering thoughts for the consideration of both believers and skeptics are most in order.

The Logic of SETI

In the astronomer’s search for extraterres-

fossils. The true nature of these alleged fossils—and the related issue regarding the presence of a fossil record of any kind on Mars—proved to be of considerable interest both inside and outside scientific circles. Kathy Sawyer, *The Rock from Mars* (Random House, 2006), reviewed in *Sky & Telescope*, December 2006, 100-101.

⁴ The University of California at Berkeley has thrown its support behind these efforts in a project called SETI@home—a project, begun in 1999, that allows anyone with a computer and an internet connection to analyze radio SETI data by using a screensaver. For more information, go to: seti.berkeley.edu.

⁵ For an overview of the world’s SETI projects—what they do, how they work, etc.—see: Sky&Telescope.com/seti.

² Steven J. Dick, *Plurality of Worlds: The Origins of the Extraterrestrial Life Debate from Democritus to Kant* (Cambridge University Press, 1982); Michael J. Crowe, *The Extraterrestrial Life Debate, 1750-1900* (Cambridge University Press, 1986); Steven J. Dick, *The Biological Universe: The Twentieth-Century Extraterrestrial Life Debate and the Limits of Science* (Cambridge University Press, 1996); Steven J. Dick, *Life on Other Worlds: The 20th-Century Extraterrestrial Life Debate* (Cambridge University Press, 1998).

³ In August 1996 came the announcement that a meteorite, found in Antarctica in 1984 and later identified as Martian in origin, contained possible micro-

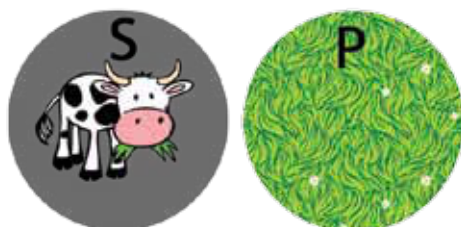
¹ Part 1, Chapter 2, of Michael Chauvin’s *The Learn’d Astronomer* (Honolulu: Mauna Kea Books, 2014); reprinted here with the kind permission of the author. An earlier version of this essay—bearing the title “The Logic of SETI”—appeared in *Planetarian*, Vol. 13, No. 2, 1984.

Internationally educated at the universities of Michigan, Hawaii, Harvard, and Cambridge, Dr. Michael Chauvin has taught astronomy at the University of Hawaii at Hilo, been a Lecturer at the Bishop Museum Planetarium in Honolulu, served as assistant director of the Program in Applied Philosophy at the University of Hawaii at Manoa, and been a resident scholar at the Smithsonian Institution in Washington, DC. Now an internationally-recognized scholar of the history of astronomy in Hawaii and the recipient, through the American Astronomical Society, of two NASA-funded research awards, he is the author of the critically acclaimed *Hokulua: The British 1874 Transit of Venus Expedition to Hawaii* (Honolulu: Bishop Museum Press, 2004).

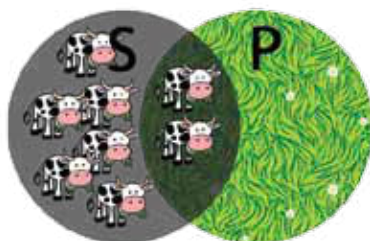




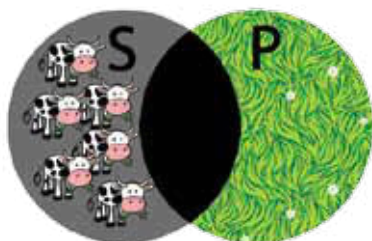
All cows are herbivores.



No cows are herbivores.



Some cows are herbivores.



Some cows are not herbivores.

trial intelligence (the acronym for which is SETI), the fundamental question is: Is there intelligent life⁶ elsewhere in the universe, or are we, the denizens of Earth, alone?⁷

6 The term intelligent life may be interpreted in either the singular or the plural, may be taken as meaning conscious aliens, humanoids, or gods—if gods are thought to be observable—or any single member of any of these classes of beings. The logical foundation of the argument presented here is class neutral.
7 On page 4 of *The Search for Extraterrestrial Intelligence* [prepared by the National Aeronautics and Space Administration (NASA) and edited by Philip Morrison, John Billingham, and John Wolfe (New York:

It is helpful, when considering this question and before making any empirical attempts to resolve it, to first examine its logical nature, and to discover, in doing so, that such an examination is significant epistemologically inasmuch as it helps to delimit human knowledge.

If such epistemic limits can be understood a priori, the scientific enterprise as an intellectual enterprise will assuredly profit; it will profit from the self-imposed restraints that are among the best rewards of sober philosophical thinking, just as it stands to be misguided without such thinking.

First, a few words about the nature of logic.

The classical Aristotelian study of the logic of deduction involves propositions—called categorical propositions—of four standard forms.⁸ These are illustrated by the following four examples:

All cows are herbivores.
No cows are herbivores.
Some cows are herbivores.
Some cows are not herbivores.

These may be written schematically as:

All S is P. (universal affirmative proposition)
No S is P. (universal negative proposition)
Some S is P. (particular affirmative proposition)
Some S is not P. (particular negative proposition)

where the letters S and P represent the subject and predicate terms, respectively. (The kind/class of proposition is indicated in parentheses.)

Now take the universal affirmative proposition “All cows are herbivores” and ask: Is it true or false? If we are empiricists and of the opinion that our decision must rest upon observation, we proceed by observing the culinary preferences of all cows.

But (we should ask) how many is “all”? The word “all” is ambiguous.

The problem would be simplified if we could say “All cows presently living on the Parker Ranch are herbivores because by counting heads—i.e., by simple enumeration—we could discover how many all species, say 5,001.”

But if by all, in any proposition of the form All S is P, is meant a set whose members are either (1) infinite, or (2) indefinitely large and

Dover, 1979)], one reads this: “How far and how hard we will need to look before we find a signal [of extraterrestrial intelligence], or before we become at last convinced that our nature is rare in the Universe, we cannot now know.” It is my purpose to demonstrate here what we can now know, and what we should never expect to know.

8 Irving M. Copi and Carl Cohen, *Introduction to Logic*, 8th ed. (New York: Macmillan, 1990), 161-190.

incapable of being enumerated—be it cows or people, stars or atoms, machines or intelligences—then the proposition cannot be verified by empirical observation.

Such a proposition can, however, be easily falsified by a single observation—one observation of, for example, a carnivorous cow.

The proposition “All intelligent beings are terrestrial beings” is similarly falsifiable.

This is what is meant when a logician insists that universal propositions are not conclusively verifiable, they are only conclusively falsifiable⁹—a statement that is true of both universal affirmative and universal negative propositions.

Consider the universal negative proposition: “No extraterrestrial intelligence exists.” This may be restated, in the logical form No S is P, as: “The universe contains no intelligent thing (or being) that is at the same time an extraterrestrial thing (or being).”

Here again is a proposition that is not verifiable; it is only falsifiable. It can be shown to be false by the discovery of a single counterexample, i.e., by the discovery of a single instance of extraterrestrial intelligence. But it cannot be conclusively verified because the things (beings) that the universe¹⁰ contains—let alone the spaces and times that might conceivably contain them—are so numerically large as to be indefinitely large, hence innumerable.¹¹

Now consider the particular affirmative proposition: “Some extraterrestrial intelligence exists.” In the logical form Some S is P, this is rewritten: “Some intelligent thing (or being) is an extraterrestrial thing (or being).”

In logical parlance, this type of categorical proposition is the contradictory of a univer-

9 J. O. Urmson, *Philosophical Analysis* (Oxford University Press, 1967), 113.

10 Even if the universe possesses both observable and unobservable features (e.g., historical properties), as well as both observable and unobservable things/beings, the falsifiability method can be the only practical method of investigating universal propositions about it.

11 Some might say not innumerable but infinite. I do not go that far because empirical observation of anything infinite is problematic. See, e.g., Bertrand Russell, “The Problem of Infinity Considered Historically,” in J. C. Smart, *Problems of Space and Time* (New York: Macmillan, 1964), 145-159. The mathematically infinite is, happily, a more tractable idea than either the spatially infinite or the temporally infinite. Take, for example, the mathematical idea of an “infinite set”—i.e., a set containing an infinite number of members. That the number of such sets is itself infinite can be easily shown by considering the set of whole numbers, {1, 2, 3, ...}: Just as this set has an infinite number of members, so too does any subset of it that begins with a different first member—e.g., {2, 3, 4, ...} or {3, 4, 5, ...}. Thus, not only can a mathematician prove that some infinities are larger than others; he can also show—abracadabra!—that there are an infinite number of them! For a more elaborate discussion of these matters, see: John D. Barrow, *The Infinite Book* (New York: Vintage, 2006).

(Continues on next page)

sal negative proposition and, as such, can be conclusively verified but not conclusively falsified. In order to falsify it, we would have to verify its contradictory, No S is P, which, as we have seen, can't be done due to the impossibility of knowing how many members are contained in the set specified by the phrase "All things/beings in the universe." (If an enumeration of this set's members were possible, it would perhaps then be possible to examine its members to try to determine which, if any, fit the descriptor extraterrestrial intelligence.¹²)

Bertrand Russell has nicely summarized these ideas as follows:¹³

Propositions containing 'all' or 'none' can be disproved by empirical data, but not proved except in logic and mathematics. We can prove 'all primes except 2 are odd,' because this follows from definitions; but we cannot prove 'all men are mortal,' because we cannot prove that we have overlooked no one ... Since we cannot examine everything, we cannot know general propositions empirically.

Empirical evidence can prove propositions containing 'a' or 'some,' and can disprove propositions containing ... 'all, or 'none.' It cannot disprove propositions containing 'a' or 'some,' and cannot prove propositions containing ... 'all' or 'none.'

For those who think about SETI programs, the empirical (observational) limits suggested here by the words "all" and "none" must constitute immovable barriers—immovable a priori barriers—and barriers that become all but insurmountable when considering not simply the (here assumed) indeterminable number of things in the universe, but also its gargantuan size and the available means of exploring it.

Using the parable, inserting doubt

Consider the parable on this page.

Now, mindful of this parable and its message, we can now ask this of SETI advocates: Suppose we could give a man as long as he desires to personally explore his entire known universe in search of beings similar to himself. When he finishes his task, supposing that his search is futile, can we then correctly conclude that he is really alone in the universe? Does he really know that he has searched everywhere? That he has overlooked nothing? That he has examined and enumerated everything? Perhaps he should go around a second time, and then a third? Perhaps those for whom he searches are purposely hiding? Perhaps they are constantly mobile and move

¹² I am ignoring the problems of such a description. Alas! Is there a consensus regarding the nature of terrestrial intelligence?

¹³ Robert E. Egner and Lester E. Dennon, eds., *The Basic Writings of Bertrand Russell* (New York: Simon and Schuster, 1961), 130.

(Continues on page 29)

A Parable

A man awakens to find himself in a prison cell. Why he is there, how he arrived, and, most particularly, what it might be like on the other side of his cell wall: none of these can he fathom in the slightest. But surmising that Somebody must know these things, he wishes to make inquiries of Somebody at the earliest opportunity.

He peers into the crack of light coming under his cell door. A lengthy hallway seems to lead away, but to where he cannot tell. He quietly presses his ear to the door and holds his breath.

Distant, but not so distant as to escape detection, he listens for, and hears, what he thinks might be Somebody's murmurs, but discerns no articulate sound that he is able to comprehend or even to suspect as emanating from a mouth like his own. In desperation he calls out—and hears, in reply, only echoes.

Can I truly be, he wonders to himself, the only occupant of such a vast and extensive prison-house?

One day, quite by accident, he finds a key that unlocks the door of his cell, allowing him to visit the cell immediately adjacent to his own. Its door is unlocked and open, but no one is there. And because his leg chains do not allow more distant explorations, he returns dejectedly to his own cell and stares at the wall.

Time passes.

One night, he rouses himself from his dreams, excitedly grabs his key, and re-visits the adjacent cell where he notices, to his delight, some evidence that the cell is occupied: a footprint, a scrap of paper, a cloth fragment. Yet, so much time has now passed since his first visit—precisely how much he does not know—that he cannot be certain that these things are not his own, carelessly left behind on a previous occasion.

Again he calls out. Again there is silence. Again he yanks at his chains. They break!

He now looks anxiously down the long, beckoning corridor. It stretches into the distance as far as the eye can see. He sees, or thinks he sees in the half-light, the figure of a childlike Hope fluttering before him, luring him onward; but he stops at the mere thought. For he realizes that even if he had the strength to wander the corridor's entire length as far as its visible terminus, he may find yet another corridor, or even a set of corridors, awaiting him along the way—corridors very like the one before him now; uncounted corridors branching off in unknown directions; even corridors within corridors, and each corridor containing its own maze of secret passages and dim caves and dark hiding places and locked doors—in sum, a labyrinthine network of cell-studded pathways, each cell begging for exploration! But (our prisoner thinks to himself) what if all those cells are empty? What if they have always been empty? What if they always will be empty?

Hit hard by this new barrage of despair-inflicting notions, he stiffens himself to ruminate upon each of them until, having bitten his nails to the quick, he begins to stagger, bleeding and forlorn, back to his cell, dragging his chains.

Collapsing onto the bed, he again stares at the imperturbable wall. But as he stares, so does his agitation increase; for he soon begins to understand, even amidst the dreadful silence, the wall's naked message: that even if, by another yet-to-be-discovered key, he could extricate himself not only from his individual cell but from the larger prison of which that cell appears to be but a small part, he might discover, when he steps outside, that he nevertheless remains inside—not inside an individual cell, it is true, nor even inside a single prison, but inside a walled city! And whether any of the prison cells anywhere in that larger city, or indeed any of the cell-like places where Somebody could hide, might actually be the dwelling place, however temporary, of one such as himself, he may never know!

He now realizes the precise nature of his condition: Given the logical truth that he is either alone or not alone, it is only the latter that he can ever possibly come to know—and only if the latter is, in fact, the correct description of his circumstances.¹ For even though the ambit of a city's wall may be larger than that of a cell's, and even though reaching that wall would enable him to lengthen his leash, enlarge his explorable space, increase his knowledge, and push back his horizons, it would be, nevertheless, a wall.

And what is a wall if not a barrier? And what is a barrier if not a limit? For although his tether would then be longer—and although it might extend as far as the city gates and beyond—he would remain, as before, a prisoner: a man whose spatial range is as confining as his time within that range is finite. In short: a quickening fetus beating its head against the wall of the womb, desperate to get out.

¹ This realization—that there are some things that a man not only does not know but cannot know—is the essence of negative epistemology.



Grass graphic: ©Yaweko, Dreamstime.com



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Passages, spirals and embody movements in the digital revolution under the Dome



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In this article I reflect on the usage of geographical visualization tools, which are naturally embedded in our daily media experience while using mobile devices, navigational tools, and other applications. With reference to well-known media scientists and philosophers, I illustrate the fact that this usage of digital geographical tools changes our mind concept of local environments, Earth, and spatial knowledge.

Further I argue that experiences in immersive environments like the fulldome planetarium with its inherent spatial taxonomy can correct and fill in the gaps of incomplete or limited Earth/universe model imaginations, while offering a concept of spatial passages and transitions.

At the end I reflect on the usage of the dome space under the umbrella of Digital Revolution, which I experienced at the enthusias-

tic, vibrant Fulldome UK Festival in November 2014.

Some questions are just popping up straight into our face, and one is: in 20 years, when most people will have their own immersive cinema in their living rooms, or will be able to take rides through the universe through their Oculus Rift¹ glasses or by using Magic Leap², or whatever the technology will be until then, will there still be anybody who wants to go to a planetarium or a dome display?

It is wonderful to see all the new art forms in the dome, from realtime visual perfor-

¹ Oculus Rift is an upcoming virtual reality head-mounted display, being developed by Oculus VR. It provides a 90 degrees horizontal and 110 degrees vertical stereoscopic 3D perspective. The Development Kit 2 released in 2014 has a resolution of 1920x1080 pixels, 960x1080 pixel per eye. The experience is quite intense, since it enables the user through the motion tracking system to turn around and see the environment all around him, as in a full sphere. A bit bizarre is the fact that your own body is being dematerialized, you look basically through your own body downwards.

² David Gelles and Michael J. de la Merced (October 21, 2014). "Google Invests Heavily in Magic Leap's Effort to Blend Illusion and Reality." *New York Times*.

Isabella Beyer (born Buczek) is a fulldome producer, lecturer, researcher and PhD candidate at the Planetary Collegium (CAiIA), Plymouth University. She teaches next to Immersive Production, Reception, and Didactic of Media. For the past 10 years she has been working as a film director and head of production as well as 360° production consultant on various films, such as *Touching the Edge of the Universe*, *Dream to Fly*, and *CuveWaters-Water for Namibia*.

In her work she specialized in science communication and science visualization, especially for 360° projection systems. Her research is based in the aesthetics of immersion, aesthetics of space, cognition, and knowledge through immersive visuals.

Facing page: The spiral staircase from *Dream To Fly* by the Heavens of Copernicus Planetarium; used with permission. Below: testing the Oculus Rift at the iii-Conference 2014 in Kiel, Germany. All images provided by the author.



fulldome theaters do believe they are seeing the real night sky and, therefore, the real world environment. Somehow their intellectual concept of Earth, the night sky, and its surrounding melds with the Digital Universe Atlas model, which we show them in the dome, into something new—hopefully a best case scenario of a new, wider concept in reference to their own location on Earth.

But how coexistent and complete can this new model in their mind become?

We, the fulldome designers,

mances (VJs), game concepts, and artistic experiences to fresh student works. But should we really put anything in the dome just because it is possible? Should we really treat the dome just as another cinema screen, a digital flat wallpaper canvas on which everything can be stretched around?

The real question for me, therefore, is how do we prevent the medium from triviality and how do we keep and grow our knowledge of the spatial experiences, while expanding and opening for new media forms and art under the dome?

A conversation, new research

My research started in 2010 with a very innocent and random personal story, one which many of you may have experienced as well. I was on the ICE (the German fast train) when I met this very nice and well-educated couple, both older and both with medical doctors.

It happened, of course, that out of the conversation they asked me what I do professionally. I thought to keep it simple and short and told them I work for planetariums. Then they asked if I was an astrophysicist. I said no, I am a visualization person, bringing images, film material to the dome surface, but I do work with astrophysicists very closely.

So then the woman responded, “oh so then you are a star and sky creator?” Well, that left me a little bit speechless, but I said yes, in some sense I am able to create stars and bring them to the dome ceiling, and we can even take you on a journey to the next galaxy. Both looked puzzled, and said: “but the stars are already there at the night sky, so you are not showing the real stars then?”

This little story showed me that, obviously, there is an important misunderstanding between the simulation of the skies in a fulldome theater and the real sky.

Some of the audiences coming into our

producers, and creators, are responsible for exactly this: establishing a “new” world model in the minds of our audiences. But this mind concept is hard to grasp and is in a continuous fluid state due to the changing media landscape and the use of different media devices.

The frequent use of navigational tools, for example driving a car, looking up the next destination, or planning our next holiday using Google Earth View, for example, does shape our imagination of distant places and strengthens our conceptualization of virtual maps and landscapes.

But more importantly, all these tools have an inherent guiding technique of a “zoom” leading the user towards the surface of the location. This zoom effect, or experience, or passing, however we want to call it, enables the chance for additional details: landscapes, regions, cities, streets, houses, people, objects, or as Stewart (p. 283)³ summarizes, “as when plummeting from satellite-range to a facial close-up, or lifting back out again.”

This scalable transition is a technology-driven effect. It is not a real passage through space or time. There is no time and space constraint; we are somehow swooshed to the other point in space, which we chose to be navigated to.

In Google Earth, once you type in your location (let’s use Rome for example), the automatic zoom location is a hard and fast passing

³ Stewart G (2007) *Framed Time: Toward a Postfilmic Cinema*. Chicago: University of Chicago Press.

of different satellite images, which overlay on the virtual Earth surface in a straight angle directly to the chosen place. For large parts of the surface of the Earth only 2D images are available, from almost vertical photography. From approximately 9 to 8 km above the surface the buildings start slowly to gain three-dimensional, rudimentary shapes. At a level of 1 km, a decent three-dimensional orientation is possible.

Additionally, there is the option to see different photos which provide fragments of the particular city from unknown users, accessed from a tour guide panel. After choosing one of these photos, the viewer is zoomed in a chunky movement to the photographed place or building and ends sharply in the planar view. The photos have no information on the viewed angle, perspective, time, or distance from where the picture was taken. Just the author of the image is mentioned and a description appears giving some details on the chosen object.

The whole motion experience is fragmented and chunky, with no connecting passages made between the different locations and no more spatial information given. Satellite images are aligned to a virtual sphere floating inside a virtual empty space. It is a space built of many gaps and voids; or, as Jihoon and Munster state:

“Despite the heightened visibility Google Earth facilitates, it nonetheless does not offer us an image of the world. Or, rather, its coverage of the world by imaging data should not be understood in terms of greater indexicality ... Un-evenness of vision is

part of its aesthetics ... The GE visual experience is far from experientially seamless ... It is a stretch of the image—the image’s deformation to provide coverage. Google Earth is the image as purely visible data, at the cost of any claims to representational purity on the part of the (digital) image.”⁴ (highlighted by the author Jihoon in his article).

⁴ Munster A (2008) “Welcome to Google Earth.” In: Kroger AM (eds) *Critical Digital Studies: A Reader*. Toronto: University of Toronto Press, 397–416 and Jihoon, K. (2014) “Remediating Panorama on the Small Screen: Scale, Movement and Spectatorship in Software-Driven Panoramic Photography.” *Animation Journal*. Chung-ang University, Seoul, South Korea, retrieved from: anm.sagepub.com/content/9/2/159. Accessed 10 January 2014.

(Continues on next page)

The problem is that these zooming experiences are structuring and forming the mind's concept of our real environment in a specific manner by technical interpretations and the picking of destinations by unknown users in a virtual coordinate system.

These visualizations, or "maps," as stated by Mersch (p.55)⁵, are instruments of domination; they do not represent, but construct, the space in which we live. GPS-mappings transform the space into an available, mathematical territory, a territory that is available for everybody at any time.

One positive aspect is that, in some way, it democratizes spatial knowledge, which was thus far only available to privileged groups (scientific or political groups, for instance). It enables users to make discoveries on their own, like, for example, the Kamil Crater in Egypt by Vincent De Michele in 2009. He discovered it using Google Earth.

Also quite clever is to use a philosophy similar to Wikipedia's that lets the users add their own 3d models using SketchUp, a 3D modeling program software, or their own data models of earthquakes, 3d forests, etc., into the Earth gallery.

Although it loses contextual and spatial knowledge, it does one thing very well: it delivers straight and as fast as possible all available visual information on your chosen location, even when that means plummeting through different satellite images on the way.

This is just the beginning regarding the fluency of movement; there is a lot more to come from Google with flight simulator, Google Maps, Google Earth Plus and Pro, Google Sky (!), Earth View, Google Ocean with seafloor topography, Street View, etc. Google also has covered most of the Earth's topography with three-dimensional buildings and landscapes.

Maybe one day there will be one big three-dimensional Google world model similar to Digital Universe. Let's impose further, that this Google world model will be available to everybody at any time and will allow users to take virtual rides to whatever location in the universe they want to go, enable users to make bookmarks, and create custom image overlays for planning trips for their next shuttle ride.

Why should then, anybody still go to a planetarium? Well, I think there will be reasons to do so, which I explain in the conclusion of this article.



Screenshots from Google Earth, zooming down to street view.

Detachment from the observed

Now let's go back to the mind concept shaped by the usage of, for example, Google Maps on a mobile device: the zooming effect also results in contradictional experiences. There is full detachment from the observed object and also the immobility of the viewer. "This immobility is counteracted by the viewers' mobile and haptic gaze on the object." (Kim, p. 170)⁶.

The operator using a device, for example, to zoom down on a specific territory develops a form of a remote virtual gaze. This new understanding of seeing through the virtual gaze blends, hopefully, with the known overview of the satellite landscape perspective. In order to process these inputs to a coherent model of a place, quite complex memory and abstraction skills are required.

Thus a necessity arises to design for the remote viewer, whom we also can call the "immobile mobile user," embodied experiences, which would offer visible context and connect the viewer with the environment around him, moving him through it.

It should be an environment that would enable connections and relations between different spaces or objects in space, one which would ensure an overview and logical transition or passage from a space A to space B, even if A and B are on different scales or ecosystems, from micro to macro levels. And, most importantly, a space that would correct the misconceptions provided by commercially-based media or geo-visualization tools.

This environment can be the IDE (immersive dome environment) of a fulldome plan-

etarium theatre. Therefore, I have been asking myself what should be taken into account while designing, in this environment, a model of a passage, which I call "Le Passage."

If we take, for example, a journey to a far galaxy, passing through thousands of light years while simultaneously moving back into time, we realize that it is a very strong experience. It also is being undertaken daily in every planetarium that has access to the scaleable universe.

But through that experience of a passage, so much can happen. First, it can distort totally the concept of the world and provide a chance for a new orientation. It can annihilate the concept of time and make void any new concept. It can neutralize, free the mind, and make space for a new model of our environment. It can influence the state of being and transfer it to something else. It can sensitize and raise awareness.

Therefore, this transition is a very important visualization tool, "a knowledge instrument" in scientific communication, especially when used in the fulldome theatre.

The dome has an important inherent taxonomy, which is positive for the creation of passages and unique experiences. This taxonomy influences the way we are telling stories in this specific environment. It forces us naturally to slow down camera movements and abandon any sudden cuts or chopped motions. We are constrained to design smooth transitions from one environment into the other.

At the Illusion Immersion Involvement Conference⁷ in Kiel in November 2014, a gaming professor from Flensburg University was negatively claiming that the fulldome the-

5 Mersch, D. (2011). "Fraktale Räume und multiple Aktionen. Überlegungen zur Orientierung in komplexen medialen Umgebungen" ("Fractal Spaces and Multiple Actions. Observations for Orientation in complex media Environments"). In G. Lehnert (Eds.), *Raum und Gefühl: Der Spatial Turn und die neue Emotionsforschung (Space and Feeling: The Spatial Turn and the New Emotion Research)*. Bielefeld: transcript Verlag.

6 Jihoon, K. (2014) Remediating Panorama on the Small Screen: Scale, Movement and Spectatorship in Software-Driven Panoramic Photography. *Animation Journal*. Chung-ang University, Seoul, South Korea, retrieved from: anm.sagepub.com/content/9/2/159. Accessed 10 January 2014

7 Illusion Immersion Involvement Conference in Kiel, Germany, www.immersive-medien.de/konferenziii (Continues on page 26)

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atre would be dogmatic per se, having the inherent slow motion constraint, which I found quite interesting.

I think we, as the fulldome designers and content creators, are more than aware of the challenges in this medium, like, for example, keeping the audience orientation. As a result, we do produce transitions in various ways, often trying to avoid hard cuts. But one can break with that “dogma” very easily, and it does not answer the question of which values the medium can offer. Neglecting the medium per se shows a missing understanding of its capabilities.

Linear concepts are being broken

One can break with the concept of linear passages and experience with new art forms, as it is already being done. VJ events showcase realtime visualization to support music expression, even if that means fast cuts or fast movements. It is a unique pulsating and energetic group experience, in which you wish the seats would disappear and one could dance and participate with one’s own body under the dome.⁸

There are quite professional artistic expressions, like RFID-Fragments⁹, in which the space is being rebuilt through fragments with

Since slow movement through space seems so natural, one can think how to expand on it, creating most intensive knowledge-forming experiences, or, as Ryan Wyatt told me in our interview 2012 at the IPS Conference, creating aesthetically-sensible guided tours through the universe.

At the conference in Baton Rouge, I was also able to discuss these aspects with such fulldome practitioners as Dan Neafus and Dr. Ka Chun Yu. They could give some important insights into the creation of unique experiences under the dome.

For Yu, for example, it was very clear how Uniview, a product by SCISS which includes the Digital Universe Atlas, changes the way a narrative is being developed. He uses Uniview to create realtime voyages around the earth for the planetarium audiences in Denver. Following the concept of Worldviews Network¹¹, Yu uses the dome to illustrate home planet problems.

The medium, in combination with Digital Universe Atlas, invites us, the fulldome designers, to create seamless moving flights through different parts of the Earth. He describes how a journey is created with a linear arc, and thus the navigation becomes the narrative in a chosen context.



RFID-Fragments, www.fulldome.org.uk/events/fragments-rfid

nice depth of field effects. Unique is that “their work is created synergetically throughout the use of interlinked processes and performance parameters of the visuals are tied to sonic processes and vice versa, often in feedback loops. Their work grows out of this interaction creating a truly audio visual performance.”¹⁰

In another piece shown at the Fulldome UK Festival, one is being flown into a sphere and experiences a manifold of fractures all around us, broken into similar glass pieces giving multiple perspectives of the space we are in.

8 I am referring to the last event by United VJs at the Fulldome UK 2014

9 Recursive Function Immersive Dome, an audiovisual entertainment environment that features 360-degree projection and surround sound.

10 www.fulldome.org.uk/events/fragments-rfid

Yu tries to include all movements in a context of a constant journey with smooth transitions. The audience flies in and out of chosen

11 The Worldviews Network: “Taking advantage of the unique capabilities of digital dome theaters, the Denver Museum of Nature & Science; the California Academy of Sciences in San Francisco; NOVA/WGBH in Boston; design/engineering firm the Elumenati in Asheville, North Carolina; and the U.S. National Oceanic and Atmospheric Administration Climate Program office in Silver Spring, Maryland, have joined to form the Worldviews Network (www.worldviews.net) through a three-year Environmental Literacy Grant from NOAA’s Office of Education. The network’s mission: Place Earth within its cosmic context and connect audiences with ecological and biodiversity issues in their backyards.” The Worldviews Network: Planetariums for Ecological Literacy, by Dr. Ka Chun Yu, Healy Hamilton, Rachel Connolly, David McConville, and Ned Gardiner, *In Dimensions* June 2012

locations and then flies to the next destination, rather than jumping from one environment to another.

This way the navigational component helps to keep orientation, because transitions are being established between specific locations and the Earth’s topography, which can appear very complex in that scale and be hard to orient oneself.

So from a philosophical point of view, this usage of the Digital Earth model enables a recreation of passages and connection that might have disappeared in the mind concepts. The Digital Universe Atlas and Digital Earth nested in Uniview or in other applications have an inherent navigational component, which directly influences our storytelling.

Inspiration from Powers of Ten

This is no wonder if one looks back to the development history of Uniview by Carter Emmart, Hayden’s director of astrovisualization, and the SCISS founders, who were inspired by the continuous zoom of Charles and Ray Eames’ 1968 classic short film *Powers of Ten*.

In this film, the viewer is being guided through a long zoom out from a viewpoint of one square meter, seeing a man and a woman on a picnic blanket in Chicago, to outer space at a rate of one power of ten per 10 seconds. It then zooms back in to the starting scene and enters the man’s body, zooming to the size level of quarks.

Of course this idea could be only rudimentarily visualized in the year 1968 with still images and little squares. But the concept behind the film was brilliant.

The aim was to realize the concept of a zoom into the knowable universe, which is now in the “real” virtual space of the Digital Universe Atlas, which takes us from a small flat screen to a changing environment around the viewer as the travel goes on.

The goal is to enable “real size and scale relationships of the universe with visual depth cuing and continuity between locations by motion with the added abilities to highlight, threshold, group, delineate, and demonstrate across time in ways that were not available before.”¹² or, as Carter explains further, “to show humanity a view of itself, alone, afloat in space around one dim star in a vastness that shrinks before us as we fly away from it, spanning the knowledge worked out by our fellow human beings.” (p. 26)

The zoom backwards into the micro cosmos of the cell was impressively elaborated

12 Emmart, C. (2005). “The Powers of Ten with a Steering Wheel on the Global Visualization Superhighway.” *Planetarian*. Vol. 34, No. 4, p. 19–26, retrieved from: cymcdn.com/sites/www.ips-planetarium.org/resource/resmgr/pdf-articles/special_focus2.pdf. Accessed 4 January 2014.

(Continues on page 28)

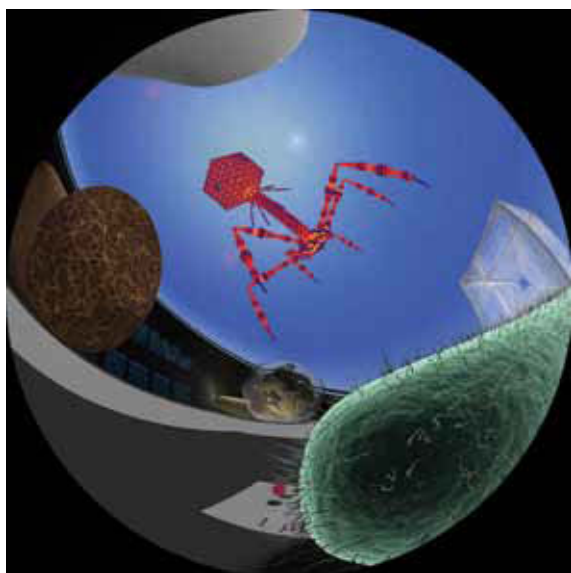
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Left: Still from *All We Are*¹³ by Carter and the Visualization Center C in Norrköping Sweden in May 2010. Above, illustrations from Kees Boeke's 1957 *Cosmic View: The Universe in 40 Jumps*, an inspiration for the Eameses' film.

for the dome in *All We Are*¹³ by Carter and the Visualization Center C in Norrköping Sweden in May 2010. I viewed the movie in 2011 and was impressed by the camera work, a continuous spiraling in, which opened different perspectives and scale relations while keeping the context of our size in the overall environment.

Dan Neafus had a nice description for it: a "spiral camera movement" in which the 360-degree space under the dome is perfectly used. The immersive effect reaches a great intensity, as one is pulled deeper and deeper down into the "smallest component parts known to humanity—a journey in scale, but also in time and space."¹⁴ At the same time, it reveals comparative scales we can see: a coffee cup, coffee bean, salt, corn, and the human egg, all inside the fulldome theatre, in which we are situated.

Copernicus Planetarium

Another spiral movement which has an immersive pull function can be found in *Dream To Fly*, a wonderfully poetic and creative show produced at The Heavens of Copernicus Planetarium. I had the chance to conceptualize and realize the Persia Scene and did the fulldome production consultation from script to final movie.

Thanks to Maciej Ligowski, project manager, and especially to Paulina Majda, the cre-

ative director, and some very talented Polish 3D artists, the show flourished and became an award-winning and unique piece of art, one of its kind. The image is illustrating a wonderful transition in a spiral movement to the laboratory of Leonardo Da Vinci.

One further mentally enriching experience in the immersive dome environment to point out is the embodied movement, which has a long history as well.

The planetarium concept was strongly influenced by Walther Bauersfeld, whose goal was to create a new spatial view. He wanted to create a new learning environment, which would make multifariousness of natural phenomena accessible to human perception (Bauersfeld 2006: 7, 1929).

Already with a star projector of that time, a very important knowledge experience could be realized, one which I would like to call the "embodied movement"—a dynamic relation between observer and image.

It is a moment in which the observer realizes that the celestial bodies are not moving around him, but it is himself who moves on Earth around the sun. Perception and understanding change dramatically. It results in an embodied movement, or the illusion of a space beyond the cupola roof.

In conclusion, the medium has high value capabilities to offer. I would like to invite you to think further on that experience and how you as the fulldome creators could achieve more of such moments.

Through the above-mentioned usage forms, fulldome can transform knowledge into experienced knowledge and offer new perspectives on relations. It can embed information into meaningful context and expand the mind concept.

Further, the IDE, because of its inherent spatial taxonomy, can correct and fill in the gaps of incomplete or limited Earth/universe model imaginations, while offering a concept of

spatial passages and transitions. This can be seen as a way to prevent the medium from triviality, while expanding and opening up for new media forms.

A library of visual and written resources has been already established through the efforts of IMERSA and can be found under the following links: <http://imersa.org/resources/materials>; <https://vimeo.com/imersa>.

We answer the question

To answer also the question, whether anybody will want to go to a planetarium in 20 years time with a sophisticated future universe model available on any private holographic projection, a far more critical view on Google is needed.

Google is still commercially driven, so despite their efforts in appearing publicly as open, their private interests still must be realized. Other interests, which might present very important knowledge, will be dropped because of a lack of commercial demand.

The Google model might miss a neutral view and understanding. In my opinion, only an educational institution with no commercial interest can provide an accurate model.

The company's thinking is algorithm based, and so are their products. This thinking does not oversee many centuries or millennia from the Big Bang to now, as we do in the planetarium; they seem to see only the now of "today" and possibly future user demands. This obviously also will influence their outcome. Thus, there will be still the necessity for neutral educational views.

Secondly, simply because you can fly into the locations, for instance, of the Holy Roman Empire, on the internet, it doesn't mean you do it every day, and if there is an exhibition close to you on your favorite topic, you would still go, because you can grab the new topic more easily through a prepared exhibition for you.

¹³ Comment from Carter Emmart, 11 November 2014 on Facebook: "Trailer for my dome movie, *All We Are*, made five years ago in Norköping, Sweden. This dome show features the AMNH Digital Universe 3D Atlas, and attempts to address the same content of the classic film *Powers of Ten*, but updated with the latest data. Executive producer, Linköping University professor, Anders Ynnerman. Producer, Anna Öst. Technical Director, Andreas Wetteborn. Modeller, Kristofer Jansson. Composer, Björn Carlsson. Production software, SCISS Uniview, Maya, Adobe After Effects."

¹⁴ www.fddb.org/shows/all-we-are, retrieved 11 November 2014

Another factor can be seen at the speed of scrolling through Facebook or going daily through the news on online sites or in your personalized news feed. The amount of news is growing and the attention span needed per news item is shrinking.

Who will be willing to dive alone on their device through virtual space for 5 to 30 minutes? It is a different experience when you can individually touch and experience the Earth model on your own, but for how long would you do that without any authentic guidance, despite how scientific or entertaining it is?

And will there not still be the need for a physical experience of a space outside the home, one that is safe and protected from the constant attention-seeking commercial media? It is an environment that will allow one to connect with other people in a physical group experience, in contrast to a growing social isolation.

Surely one main aspect that will survive in the future is the social component and the scientific authority. Live actors, lecturers, artists, and hosts will be needed to differentiate what we do and guides, and who will be able to moderate and fly the audience around Earth and out into the universe¹⁵—the new generation of space pilots.¹⁶

Media usage continues to change dramatically. If we consider the development of online and mobile media with regards to commercial television, for example, new generations may prefer to watch television through online services and on demand. The television format already is dying out.

¹⁵ Dan Neafus, IMERSA co-founder and manager at Gates Planetarium, in our ideas exchange in January 2015

¹⁶ A metaphor by Eduard Thomas, director of the Kiel Planetarium, Mediendom, in Germany in our discussion December 2014

Thus a certain percentage of future planetary audiences that also could be lost, but the numbers depend on how planetariums integrate and connect themselves to the new media possibilities. There is potential to learn from the global players in developing trans-medial concepts, where the focus is not only on producing shows, but also creating a story universe told through fulldome shows, games, Oculus Rift experiences, exhibitions, online presentations, second screen applications, and more.

Think about Dream To Fly and wonder: wouldn't it be nice to have also the possibility to experience flying inside the Oculus Rift Environment? The future of our medium stays interesting; we just need to adapt it for future audiences. ☆

(The Logic of SSTI, continued from page 29)

when he does, always maintaining a prescribed distance? After all, must not the hunted be where the hunter looks when he looks in order to be found?

Such doubts will only be put to rest if Others truly exist and if they are found. There is a large and unbridgeable chasm between the statement They haven't been found and the statement They don't exist. We might, it is true, empirically (observationally) confirm the existence of X. But because something that doesn't exist cannot be observed, its non-existence cannot be empirically (observationally) established.¹⁴

True or false?

The conclusion to be drawn here is this: The statement (A) "Some extraterrestrial intelligence exists" is such that, if true, it can, logically, be shown to be true. If false, it cannot be shown to be false. That is, in principle, it is em-

pirically verifiable but not falsifiable.

Alternatively, the statement (B) "No extraterrestrial intelligence exists" is such that, if false, it can, logically, be shown to be false. But if true, it cannot be shown to be true. That is, in principle, it is empirically falsifiable but not verifiable.¹⁵

Simply expressed: If ETs exist, we may some day know that. If they don't, we shall never know that. And it is the combined force of these two logical truths that provides the lure, and the rub, of all SETI programs.

It is important to point out that none of what has been said here tells us anything about which statement, A or B, is in fact true. Nor does it tell us what procedure(s) to follow in order to find out which statement is, in fact, true. But it does, importantly, tell us what to expect and not expect. And it tells us this before we begin our scientific investigations—i.e., a priori.

If, then, our SETI efforts are poorly conceived and fail, we might at least be able to understand why they have failed, surely a profitable lesson.

Nor is this our only consolation. We can find yet another in the logician's Law of the Excluded Middle: For if this law is correct, then one of the above statements, either A or B, either the Particular Affirmative or the Universal Negative, must be true, the other false. They cannot both be true. Neither can they both be false. That is just the way the Universe

is—or at least that is the way it is believed to be.

And all science rests upon that metascientific belief—the belief that the universe is rational and can be understood by what is called logical thinking.

This is at least a happy beginning. The question is: Where do we go from here? ☆

The Learn'd Astronomer, softcover. 183 + ix pages. Price: US \$18. From: Mauna Kea Books, P. O. Box 10272, Honolulu, Hawaii 96816.

(Strategic Plan, continued from page 6)

- Lack of professional development, lack of professional working partnerships, lack of interest in young tech/social media/animators professionals

The task ahead for the V2020 Planning Team and IPS Officers is to draft our mission, vision, and value statements based directly from the SWOT survey results. During this summer's IPS Council meeting in Montreal, Canada, a strategic planning facilitator will assist in finalizing the draft documents to be presented to Council for review and further input.

Our ultimate goal is to present an articulated, vetted road map for where IPS is headed at the 2016 conference in Warsaw.

If you are interested in participating in IPS' future, please take a moment to review the strategic planning document on the web page listed above.

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¹⁴ There is no act of sense perception that can prove an absolute absence except insofar as that absence, like the perception of it, is both temporally and spatially restricted. Thus it is possible, within a domain thus restricted, to confirm something's non-existence by the lack of observational data—to agreeably demonstrate, for example, the non-existence at this time of an island in the Kaiwi (Molokai) Channel at latitude 21°20' North, longitude 157°30' West—or, more apropos astronomically, the non-existence of a planet, Vulcan, within the orbit of Mercury. In such cases the observation of nothing is, ipso facto, also the observation of something, viz., lack of empirical data (the paradox is spurious); and one can reasonably assert that absence of evidence is evidence of absence, and can mathematically represent that absence with the null set. If, however, the domain of SETI programs is unrestricted—which it may or may not be in, for example, the multiverse imagined by British cosmologist Martin Rees—then the non-existence of ETs could not be confirmed by beings who have no access to such indescribable places.

¹⁵ The fact that statement A is not falsifiable while statement B is falsifiable will pose a challenge to disciples of Karl Popper: On which side of his famous line of demarcation between science and non-science (the latter of which includes "pseudoscience" and "metaphysics") would he place SETI? Karl R. Popper, *The Logic of Scientific Discovery* (1968), Chapter 1, Part 4; Appendix 1.



From the Classdome

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Updating classroom lessons

We are deep in the “testing season” at our school, where it is almost as wild and crazy as football season. It also provides me with a 3-week window to update and edit presentations before the end-of-school-year push.

I have observed this school year that a couple of my presentations have some dated information or use techniques that are not as engaging as it should be for the students.

One of my presentations getting a lot of my time this break is my lesson on meteors, asteroids, meteorites, meteoroids, and comets. The information hasn’t really changed and there isn’t a new definition for asteroid.

The issue is that it doesn’t mention recent events, like how to say Chelyabinsk, and I felt the use of the word bolide for 6-8 grade students was a bit extreme. I don’t have to rewrite the entire presentation; I just need to adapt the sections with the problems and render them.

Working on gravity

One of the other lessons that is getting some time from me is the one on gravity. I have worked with Dr. Siobahn Morgan at the University of Northern Iowa’s AJJAR resources (www.uni.edu/morgans/ajjar) for many years, I even got to be one of the field testers of a couple of the Kepler’s Law simulators.

The simulators are simple enough for my younger students to use without an issue, yet give enough accurate information for reliable simulation.

The issue has been that they are Java-based and periodically need updates and permissions to function. If you are running it as a kiosk the changes in plugins and addons aren’t that bad, but I am running a lab with 30 computers that at any moment it would seem one

of the computers will miss an update and the simulator will not load.

So, for a couple of the labs, I have had to recreate them in JavaScript without the graphics portion (the little simulated person getting squished by a planet’s high gravity) or visualization of the eccentricity of a planet’s orbit. While these visuals did not provide essential information for the lab, they were nice to help engage the students.

The gravity lesson I am rewriting deals with

Table 1

Planet	Mass	Radius	Gravity	Jump Height
Inky	1	1		
Stinky	1	2		
Blinky	2	1		
Bob	2	2		

jumping on different planets. I did not want the students in sixth grade to have to calculate gravity for our simulated planets that were already based on Earth mass and radius and I could quickly simulate using $G=m/r^2$ to calculate the ratio.

The first step is for them to measure their standing jump height in centimeters, and use this number in the simulator webmail.ops.org/~jack.northrup/JumpingLab1.html.

The simulator’s output includes the planet’s gravity and jump height without the original AJJAR simulator’s animated jumping character. For the reflection question, they have to answer these statements describing the relationship of mass and radius to gravity:

- If mass increases and radius stays the same, what happens to the gravity?
- If radius increases and mass stays the same,

what happens to the gravity?

- As gravity increases, what happens to your jump height?

Older students have access to a data table with the mass and radius for each planet in the solar system measured in terms of “Earth.” We then experiment with some of the data from exoplanet discoveries to find the possible surface gravity.

Unlike many of my lessons, I do not have the students make a graph; it is easier to have them just look at the relationships between mass and radius. Not only the inverse, but also the inverse-squared relationship between radius and gravity, is one of those ah-ha moments that the students will have.

The AJJAR simulation that taps into my students’ inner 2-year-old is called Craters (www.uni.edu/morgans/ajjar/Gravity/craters.html).

If you do it correctly, eventually you create an impact so large that it destroys the Earth. For this lesson, to try to rein in the destruction, I have them fill out Table 2.

While none of these will get to the magic planet killer, it is good for them to look at the relationships between the different values.

I didn’t just rewrite old presentations during this season; I also am preparing a new lesson on ancient explorers, starting with how to use the sun and Polaris to navigate and taking it all the way up to how to use a sextant.

When the social studies teacher first approached me about bringing his classes to the planetarium he was thinking about sundials. When he showed me the text that went with the unit, we decided that learning how to use a sextant would be a better application in the planetarium. Navigating with the stars was a nice bridge to the next unit they will be covering, which is tools and inventions.

My original plan was to just use the star projector to simulate the pristine sky you would see without light pollution. In my initial tests, however, I felt that starting the lesson immediately in the dark would make it difficult for the audience to see me use the meridian markers, so I am going to use the fulldome system to have them learn the process of using a sextant and then switch them to the star projector to apply the skills. ☆

Table 2

Test	Composition	Diameter (m)	Velocity (km/s)	Angle (degrees)	Crater Radius
1	Rock	1	20	45	
2	Rock	1	20	60	
3	Rock	1	20	90	
4	Rock	2	20	90	
5	Rock	4	20	90	
6	Rock	8	20	90	
7	Rock	16	20	90	
8	Rock	16	40	90	
9	Rock	16	60	90	
10	Rock	8	80	90	
11	Rock	4	100	90	
12	Ice	1	20	45	
13	Metal	1	20	45	

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Open WWT

Last issue's column was titled "Worldwide Telescope: Past, present and future." Unfortunately, given the uncertainty regarding WWT's future at the time the column was written it, wound up being more about the past and present. In the last couple of months a lot has happened. Here is a quick update.

During the January American Astronomical Society meeting in Seattle, Washington, the Open WWT initiative was announced. WWT is in the process of transitioning to a community-based open source project. Microsoft Research is supporting a small team, led by Doug Roberts, for the first half of this year to help manage this transition.

Jonathan Fay, although currently working at Microsoft in another capacity, is currently assisting the team in preparing the code and documentation so that it will be ready to release on GitHub in the coming months.

The open sourcing of WWT has been well received by the astronomical community. In the future, WWT will likely play a large role, not only as a data exploration tool but also as an academic publishing resource.

There is revolution going on in how academic articles are written, presented, and shared. A really great overview of what the future could/should look like is presented by Goodman et. al in "The 'Paper' of the Future" (www.authorea.com/users/23/articles/8762/_show_article). The paper of the future won't just contain a description of the results, but will also contain the data and analysis code used to generate those results.

WWT can play an important role in the era of interactive scholarly publishing. We can do more than just include a picture of an astronomical image in a printed article or a PDF file; a tool like WWT can be used to place that image in context on the sky, allowing the reader to manipulate it and overlay other datasets and imagery.

WWT exists both as a Windows application and an html5 web application. One concern is that the applications like academic publishing and other uses by the professional astronomy are more likely to involve the web application.

The same is true of the K-12 education community, where there are often challenges to



installing software in schools.

In the open source era, the Windows application may not receive the same development pressure as the web application. In fact, the planetarium community may very well be the group most interested in the continued development of the Windows application. If the planetarium features of WWT are to continue to improve, people from our community will need to step up and contribute to its development.

Working with data

The past couple of issues have included data tutorials in the form of a iPython note-

books. We'll continue to release a new tutorial with each issue, but will no longer bother to print the python code in this column. All of the tutorials can be found in a GitHub repository (github.com/IPSScienceVisualization) managed by the Science and Data Visualization Task Force.

This month's tutorial describes how to pull a set of Milky Way datasets (globular clusters, planetary nebulae, supernova remnants and many others) from the Vizier (vizier.u-strasbg.fr) Catalogue Service and create data modules for various planetarium software packages. Many of us regularly present similar data to our visitors.

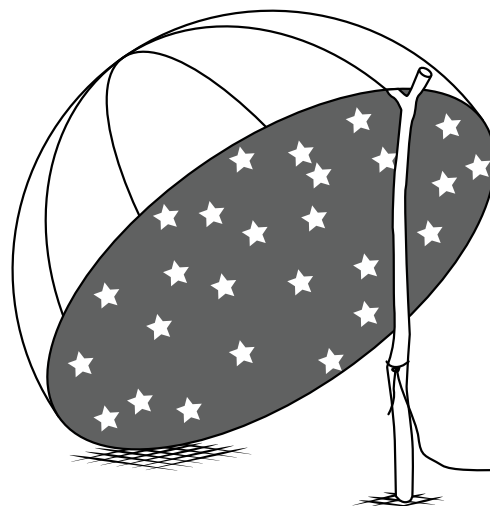
The idea behind this tutorial is to demonstrate the power of including the code with the data module. As soon a new paper comes out with a newer, larger or better catalog of one of these classes of objects, a new data module can easily be generated using the code in this tutorial.

We hope that the tutorials will promote a way of working with astronomical data efficient, powerful and open in our community. To further these goals we will be holding hands-on workshops, with the first scheduled for the 2015 IMMERSA summit. While much of what we are trying to accomplish is system agnostic, representatives from most of the major vendors will be present to assist workshop participants.

A longer multi-day stand alone "Data to Dome" workshop is in the works for later in the year—stay tuned for details. ☆

Bard Spiral Tales of life, the universe and a few other things. By Chuck Rau

HOW TO CATCH A PLANETARIAN:



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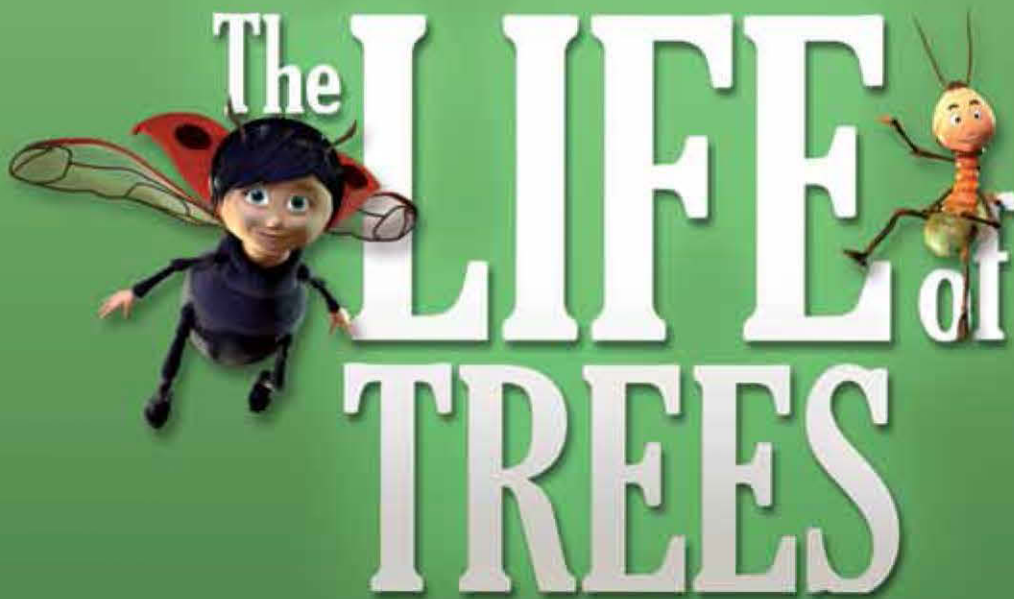
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carolyn@lochnessproductions.com

An 8K-15/70 shootout

The Dome theater at the Science Museum of Virginia (in Richmond) hosted a Giant Screen Cinema Association Digital Dome Day on the heels of the October 2014 Association of Science-Technology Centers (ASTC) meeting. The event showcased The Dome's newly installed Evans & Sutherland 8K system, pitted against a 15/70 film system, in a first-ever "shoot-out" between the two different projection systems.

Attendees noted striking differences between the two methods, including a lack of jitter, dust, and film yellowing in the digital projectors. A number of those in attendance felt the Digistar 5 to be a viable alternative to film projection on a dome.

Tina Ratterman of Big & Digital commented "The colors on the digital projection were much more vivid and vibrant than film and the image quality was excellent in 8K. This is a really good solution for 15/70 dome theaters considering converting to digital or laser that will provide new opportunities for programming giant screen content and astronomy demonstrations."

The shoot-out amply displayed that 8K systems can offer a route for producers willing to "converge" with fulldome to bring their productions to wider audiences. You can read more details about the shootout and attendee reactions in an exclusive article at imersa.org/item/cinema-shoot-out-in-virginia-8k-fulldome-takes-on-1570-film.

Teaching dark skies for the IYL

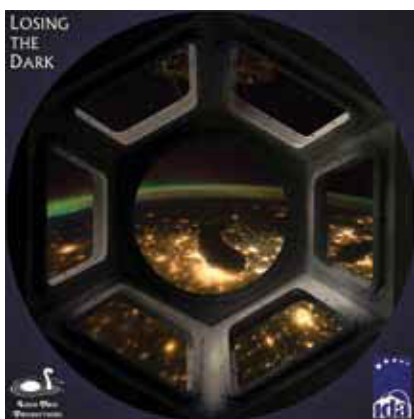
Recognizing the usefulness of fulldome theaters for public outreach, the organizers of the International Year of Light selected the short fulldome video *Losing the Dark* as a featured resource for public education about light pollution.

The show was produced by Loch Ness Productions for the International Dark-Sky Association, and teaches audiences about the causes and effects of light pollution and some simple solutions individuals can take to help mitigate it.

The International Year of Light is a series of events sponsored by UNESCO that kicked off on January 1, 2015 and features activities centered on understanding light and its effects and uses around the world. Light pollution is part of IYL's message about the uses of light.

Explore their IYL Videos page at www.light2015.org/Home/About/Resources/Videos.html

The video, sponsored by a seed grant from the International Planetarium Society and with major funding from Star-Map.fr, the Fred



Still from *Losing the Dark*, courtesy Loch Ness Productions

Maytag Family Foundation, and IDA members, is available free for download in both fulldome and flatscreen formats (or via USB for a small fee for theaters needing dome masters).

More information is available at www.lochnessproductions.com/losingthedark and www.darksky.org/losingthedark; a link also can be found on the IPS website at www.ips-planetarium.org/?page=fulldomemasters.

Habitat Earth opens at Morrison

The California Academy of Sciences (San Francisco) opened its new Morrison Planetari-

um fulldome production called *Habitat Earth* in January. The show takes visitors on a trip through varied ecosystems in a unique way, using visualizations created by teams of animators in and out of the Academy.

According to Ryan Wyatt, director of Morrison Planetarium and Science Visualization, the show advances the boundaries of traditional planetarium content, which focuses primarily on astronomy and space. "Instead of looking solely to the stars, the Morrison team is using advanced digital tools and scientific data to tell stories that are uniquely Earth-focused," he said.

The show, narrated by Actress Frances McDormand, incorporates stunning visualizations into a story of how human and biological worlds intersect across the globe.

Attendees at the Morrison Open House (for fulldome producers) in early February were treated to a presentation of the show, as well as discussions with the production team about how the scenes and animations originated and evolved.

A full-length preview of the show is available on the Academy's distribution site, and you can also download the soundtrack on iTunes! Read more about *Habitat Earth* at: www.calacademy.org/habitat-earth.

Big Data paints the dome

We live in an era of big datasets constantly streaming from the world's observatories and space missions. Perhaps you've seen stories about the Sloan Digital Sky Survey, Hubble's Deep Field observations, and others, and wondered if you could use them in your fulldome system.

It turns out much of that information can be adapted to the dome and used in a variety of presentations. A growing army of science visualizers in the science and fulldome communities are exploring ways bring big data to fulldome systems.

Adler Planetarium's Mark SubbaRao and director of Adler's Space Visualization Laboratory chairs the IPS Science and Data Visualization Task Force. Their job is to bring planetarians into contact with these big data sets for their own use.

Mark organized an IPS-sponsored visualization workshop for the recent IMERSA Summit in Denver, designed to focus on bringing big data sets to the digital dome. The event provided an understanding of how to acquire, manipulate, and visualize astronomical data sets, with an eye toward developing some "best practices" for the data visualization in the dome.

(Continues on page 40)

Carolyn Collins Petersen is CEO of Loch Ness Productions, producers and distributors of fulldome videos, music, and providers of fulldome- and science outreach-related services. She is an IPS Fellow and formerly served as IPS Publications Chair.

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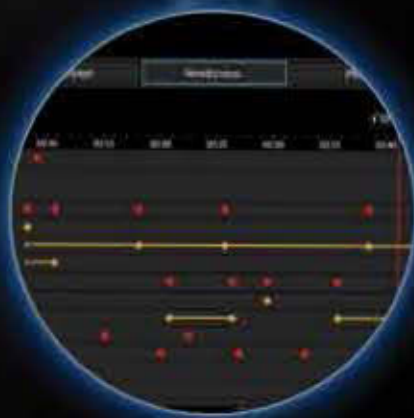
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Charlie Mary Noble and a young visitor. Photos courtesy of the Fort Worth Museum of Science and History.

By Scott Sumner Assistant Planetarium Manager

Charlie Mary Noble was a dedicated Fort Worth high school math teacher with an abiding passion for astronomy. Her dreams of a planetarium, where she could introduce students to the stars, started to take shape in the 1940s in a humble tent behind what was then the new Fort Worth Children's Museum. It was the very first planetarium at a children's museum.

When the museum moved to a new location, the planetarium was integrated into the new building and dedicated to Miss Noble in 1955.

This May, in what is now known as the Fort Worth Museum of Science and History, we will celebrate the 60th anniversary of the Charlie Mary Noble Planetarium.

To celebrate the anniversary, the planetarium has produced a fulldome documentary on her life that will be shown throughout the year.

It is a fitting tribute to a woman who literally inspired generations of students. In 1947, for instance, she created the Junior Astronomy Club through the museum. It was one of the first science-based clubs for children in Fort Worth. The program spread around Texas and as far as New Mexico, where excited students wrote letters telling her that they had passed her certification test.

Notably, the club was asked to participate in the Moon Watch program created by the Smithsonian's Astrophysical Observatory. This group of citizen-scientists helped track Sputnik when it launched in 1957. Club members also sent birthday wishes to noted scientists, and they received responses from many, including Albert Einstein.

Miss Noble was recognized locally and nationally for her work. She corresponded regularly with the director of the

Under One Dome

**Charlie Mary Noble Planetarium
Fort Worth Museum
of Science and History
Ft. Worth, Texas 76107 USA**

Adler Planetarium in Chicago, sharing opinions on articles and teaching methods. During World War II, she helped train soldiers in math, astronomy, and celestial navigation at Texas Christian University. The university recognized her achievement with an honorary doctorate in 1950.

Charlie Mary Noble died in 1959 at the age of 82. But her influence lives on in the lives she touched, and her work continues at the Museum.

To learn more about the 60th anniversary plans, visit the museum's website at www.fwmsh.org

The 90-seat Noble Planetarium brought the first Zeiss-manufactured hybrid planetarium system to the Southwest United States. The planetarium also features an exhibit area that provides large screens with up-to-the-minute views of



The Zeiss under the Noble dome.

the sun, as well as downlinks offering the latest information from the Hubble Telescope.

The Zeiss SKYMASTER ZKP-4 star projector works with the planetarium's Sciss Univeiw system.

In addition, it operates a mobile planetarium to take the stars to area schools, called the Mobile Noble Planetarium. ☆

Mark said the aim of the Task Force is to help planetarians become more data savvy as they incorporate new information into their presentations and productions.

"We are trying to promote some modern ways of working with data in the planetarium community," he said. "The goal is to both to expand the number, types, and quality of data sets visualized in the dome but also make it easier to share work among planetarians (even those with different systems)."

Mark has posted some tutorials on data acquisition for fulldomers. You can find them at github.com/IPSScienceVisualization/python-tutorials. (See also the **Data to Dome** Column on page 32 in this issue of *Planetarian*.)

IMERSA News: Summit 2015

The annual Immersive Media Entertainment, Research, Science and Arts (IMERSA) group Summit, held February 25-March 1, 2015, provided an array of workshops, demos, and shows for the producers, artists, writers, equipment experts, and visualizers in attendance.

Participants heard from panelists on topics ranging from how the fulldome medium is defined and how we produce for it, types of content and business practices (and failures) for both independent and institutional productions (accompanied by case studies). They also experienced demonstrations of audio production, watched new shows, and heard about new spaces, visualizations, and education research.

Attendees also saluted Ian McLennan as this year's honoree of the Lifetime Achievement award (see box), visited Fiske Planetarium to see shows on its newly installed Sky-Skan Definiti 8K system, and spent time brainstorming new ways to use fulldome for a variety of outreach projects. You can read more about the Summit at IMERSA.org.

Changes at IMERSA

The new year brought personnel changes to IMERSA. First, Judith Rubin, known to many readers as the former author and editor of this column, has resigned her position as IMERSA's director of communications and development after faithfully serving the organization since its inauguration in 2008.

In her work for IMERSA, she worked tirelessly to evangelize the possibility of fulldome. In addition to *Planetarian*, her articles have appeared in dozens of media outlets, including *InPark Magazine*, *Funworld*, *Lighting&Sound America*, *Sound and Communications*, *Live Design*, and *LF Examiner*. Judy was instrumental in forming ties between IMERSA and GSCA, TEA, PGA and SIGGRAPH.

(And Judy continues her writings about fulldome in "Visualizing the Data," starting on page 12. -ed.)

Ed Lantz, president and CTO of Vortex Immersion Media, stepped down from his position as IMERSA Director after serving as founder and supporter since 2008. He is increasing his focus on the pioneering business models aimed at the financial success of domed theaters aimed at arts and entertainment programming and the continued promotion of excellence in related fulldome content creation.

Honoring Ian McLennan

Long-time museum and planetarium consultant Ian McLennan was honored with IMERSA's 2015 Lifetime Achievement Award during the IMERSA Summit banquet, held February 27, 2015.

"Ian is one of the statesmen of our profession," said Dan Neafus, IMERSA host and manager of the Gates Planetarium at the Denver Museum of Nature and Science. "The fulldome community as a whole, and IMERSA particularly, owes a great deal to his foresight—and his sense of fun and humor. It's only fitting that we give him our accolades and our highest honor."

McLennan's IMERSA honors salute a body of work and service to the museum, science center, planetarium, and attractions community going back to the 1960s and his first job as director of the Queen Elizabeth Planetarium in Edmonton, Alberta. Through his company, Ian McLennan Consulting (www.ianmclennan.com), he continues to fill an important niche in public project planning and administration, working through all phases of a project's life. ☆



In leaving IMERSA, he commented on the group's growth. "Consider that it was 10 years ago that Ryan, Dan and I produced the first Fulldome Standards Summit at IPS 2004 in Valencia, Spain," he said. "This seed has sprouted into an impressive organization that will continue to serve the fulldome community for years to come."

Through Ed's work, IMERSA grew to embrace a wide variety of venues, and most recently became a founding member of International Fulldome Arts Alliance. This group is working to open a touring circuit for arts and entertainment programming.

"Judy and Ed are both founding pillars of this movement we now call IMERSA," said Neafus. "On behalf of the board of directors, we are grateful for their hard work and passionate support of our vision and look forward to their participation as advisers on future projects."

Carolyn Collins Petersen, CEO of Loch Ness Productions (a founding member of IMERSA) takes over the column with this issue. She has extensive experience in the planetarium and fulldome community, and worked with Judy on public relations for previous annual summits. She also now serves as IMERSA's new Communications Coordinator.

Future Directions for this Column

As the immersive and fulldome worlds

grow and evolve, we see a lot of news about developments in programming, equipment, standards, and producers. As space permits, I want to expand this column to include timely notes about such topics as new show productions and show openings, acquisitions and upgrades to fulldome systems, new theaters, advances in technology in hardware and software for fulldome and immersive theaters, and other events occurring in the fulldome

world. Drop your notes to me at: Carolyn@lochnessproductions.com.

Save the dates

Central European Fulldome Festival Brno,

April 13-14, 2015, a festival focusing purely on showing fulldome content, held in conjunction with the Academia Film Olomouc Festival, the biggest European festival of popular science documentary films. starrylab.org/festival

Fulldome Festival, May 28-30, 2015, the ninth annual gathering in Jena, Germany, will take the theme "romantic circles." fulldome-festival.de

Reflections of the Universe, June 16, 2015, Valentina Tereshkova Cultural and Educational Center, Yaroslavl, Russian Federation. Created to spur public interest in fulldome and the planetarium, and its impact in cultural and scientific fields. www.festival.planetariums.ru

SIGGRAPH, August 9-13, 2015, Los Angeles, California. The annual SIGGRAPH conference is a five-day interdisciplinary educational experience in the latest computer graphics and interactive techniques.

Fiske Fulldome Festival, August 6-15, 2015, a new festival that will include a public showcase for fulldome films as well as a three-day showcase for filmmakers and professional judges. fiskefest.com ☆

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International News

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www.orionplanetarium.dk

Dear fellow planetarians:

It is with some anxiety, but also with eagerness, that I write this, my first International News column, after the baton has been passed on to me from Lars Broman. I will like to thank Lars for his almost two decades of dedicated work for IPS in being responsible for this section in *Planetarian*, and also for all the good advice he has relayed to me. I know those are big shoes to fill, but I'll try to do my best to serve our society in this new task of mine in the coming years.

It is very inspiring to learn of all the exciting activities and the development of new ways of communicating astronomy that are taking place all around the Earth, and I can only admire the brave work done by Irena Filippova, when she is running her planetarium while missiles are falling around her.

For this section I am indebted to contributions from Ignacio Castro Pinal, John Hare, Rachel Thompson, Bart Benjamin, Michele Wis-tisen, Alex Delivorias, Vadim Belov, Christian

Theis, Aase Roland Jacobsen, Loris Ramponi, and Agnès Acker.

This tour around the globe will start in the Americas.

Association of Mexican Planetariums

The Planetarium Torreon, in the State of Coahuila, Mexico was host to the 1st International Planetarium Festival on 3-7 December 2014, coinciding with AMPAC's XLII meeting, becoming one of, if not the best and largest, AMPAC meetings. There were representatives from at least 20 planetariums from 15 states in Mexico and planetariums and institutions from the United States, Europe and South America.

Please note, that a few last-minute changes were made to the program as described in the news report in the December issue.

The Festival's inaugural ceremony was presided by Torreón Mayor Miguel Angel Riquelme Solís, and by invited guest star José

Hernández, the first Mexican-American astronaut, Torreón's Planetarium Director Eduardo Hernandez and governmental authorities. José recalled some principles he pursued since his childhood to attain his goal in life, to become an astronaut, and left a great impression on students attending as a role model to follow.

Lucía Sedon, director of the Galileo Galilei Planetarium, Argentina, and current president of APAS, the South American Planetarium Association, talked about their transition from optical mechanic to digital projection, not only technically but also financially. He also gave examples of developing special dome programs for the blind and audibly impaired.

An agreement of collaboration was signed between APAS and AMPAC.

Jesús Mendoza Alvarez from Mexico's National Science and Technology Council spoke about the many facets facing public policy in science and technology communication to different audiences.

Alex Zwissler, director of the Chabot Space & Science Center Planetarium, Oakland, California, described how they made the production of the *Mayan Universe* program.

Marc Moutin, exhibitions director from Cité de l'Espace, Toulouse, France described their vast and varied public facilities, exhibitions, and planetarium programs as well as the center's educational programs.

Michael Daut from Evans & Sutherland spoke about developing a planetarium show and considerations to be undertaken, including such topics like establishing concept, making decisions, identifying the audience, refining the concept, working through production and post production, recording sound tracks, evaluating, and reviewing lessons learned. He provided very valuable tips for all in the program production: to never give up, to make the next show even better, and to never stop creating.

José Franco, director of Science and Technology Consulting Forum, Mexico, presented a brief history of the Night of Stars, with its origin in France, to show how it was implemented in Mexico with an annual participation of more than 53 sites throughout the country and 150,000 attendees.

Digitalis and Meade telescopes representative José García asked attending Digitalis planetariums to share



AMPAC: Members and international planetarium representatives attending the 1st International Planetarium Festival, coinciding with AMPAC's XLII meeting at Planetarium Torreón, Coahuila, México. Courtesy of Fernanda Plascencia Leyva, Planetarium Torreón.

their experiences with their equipment operation and public programs.

E&S's Mexico representative, Enrique Fonte, lectured on "The Creation of a Planetarium," presenting all the physical, financial, technical, and human resources considerations and planning aspects to be taken into account before, during, and after building a planetarium.

Enrique was responsible for bringing E&S instructors Nathan Hanson, Marty Sisam, and Michael Daut together with Mexican instructors Wilder Chicana, Jorge Satré, and Javier Minchaca from Planetarios Digitales to give a three-day workshop to 21 planetarians. Topics covered included fulldome production and construction of 3D models to be processed by planetarium software and be reproduced in the dome, employing 3dsMax, Photoshop, AfterEffects and Digistar 5.

Robin Sip from Mirage 3D, the Netherlands, presented the making of programs such as *Natural Selection* and *Dinosaurs at Dusk*, explaining the many facets a show producer has to undergo to make a great scene and reproduce reality.

Estelle Pacalon, planetarium designer from RSA Cosmos, presented their programs.

Southeastern Planetarium Association

Mark your calendars for 23 June thru 27 June 2015! SEPA will hold its annual conference at the Tellus Science Museum in Cartersville, Georgia. The official conference hotel is the Holiday Inn of Cartersville. Mention "SEPA" when registering to secure the reduced conference rate.

Nestled in the mountains of north Georgia, the conference site is about a 1-hour drive north from Atlanta's Hartsfield airport.

A special treat is in store for delegates. Friday, during conference week, marks the day that the New Horizons spacecraft will begin to stream data from its mission to Pluto. The spacecraft was designed and built by the Johns Hopkins University's Applied Physics Lab. Mark Kochte from Johns Hopkins will speak at the luncheon on Friday.

Kochte was a mission specialist on the Mercury Messenger team and will be taking a mission specialist position for New Horizons-Pluto encounter. He works for the Applied Physics Lab as a contractor through NASA.

On-line registration opened on 1 January. Registration and additional conference information is available at: sepadomes.org.



Southwestern Association of Planetariums

The year's holiday season at Noble Planetarium was a success, thanks to the donation of the script *Search for the Star* from John Cotton of the former Dallas Planetarium in Fair Park. Since the Fair Park Planetarium closed, many resources like *Search for the Star* have gone unused.

The revived show, a classic "star of Bethlehem" program, was reworked for the Noble Planetarium system and opened within two weeks of receiving the script. Each day the program ran brought sold out shows. Audience members shared glowing reviews of the program.

The Noble staff is also bringing back a show from its own collection of past programs, *Star Crossed Lovers*. The program ran from 1-15 February for Valentine's Day. A brand new, in-house production is planned for May when the Noble will celebrate its 60th anniversary.

The New Mexico Museum of Natural History & Science Planetarium invites you to the Western Alliance Conference in Albuquerque, New Mexico. The conference is 29 July to 2 August, but there are also exciting pre- and post-conference activities you won't want to miss!

Register online at www.wacdomes.org.

Albuquerque's 55-ft dome seats 150 and features a newly-installed 4K digital projection system from Sky-Skan. The adjacent observatory and deck will be used for evening activities. Most paper sessions, workshops, and vendor displays will be hosted in the museum's renovated education wing. Two floors of exhibits highlight the incredibly rich natural history of New Mexico.

For further information visit www.nmnaturalhistory.org.

Several notable individuals living near central New Mexico may deliver talks during meals and workshop sessions, including former astronauts, geologists on the Mars Opportunity Rover team, archaeoastronomy researchers, and experts on the sun and meteorites.

The conference hotel, Hotel Albuquerque, is two blocks from the museum and is offering a conference rate of \$108. Additional accommodations are a short distance beyond. Opportunities for shopping and dining are available in Old Town, also only two blocks away.

A mid-conference tour to the Very Large Array radio observatory is planned with a boxed lunch and guided tour of the dishes and maintenance shop. The day includes transportation to the facility, approximately 1.5 hours away from the museum, with expert commentary on the geology of New Mexico along the way. A quick look at the Long Wavelength Array and Magdalena Ridge Observatory will also be scheduled. Dinner and optical observing in a dark sky location near Socorro, New Mexico may also be included.

Planning is underway for a pre-conference trip to see the newly-opened Los Alamos Nature Center Planetarium, along with a tour of a linear particle accelerator and possibly the Bradbury Museum.

After the conference, there may be a two-day trip to southern New Mexico, based out of Alamogordo, with stops at the New Mexico Space History Museum and Clyde Tombaugh Planetarium, Apache Point Observatory, and White Sands Missile Range Museum.

Great Lakes Planetarium Association

Illinois. The Peoria Riverfront Museum's Wine and Cheese under the Stars series continues to be a success. The staff created a live show called *Interstellar Voyagers* to accompany the showing of *Interstellar* on the museum's Giant Screen Theater, and completed a holiday show titled *Season of Light*. Following the example of the Abrams Planetarium, the staff has started a "Relax Under the Stars" program once a month during the lunch hour.

The William M. Staerkel Planetarium at Parkland College in Champaign reopened for public programming on the 16-17 January weekend. Their "World of Science" lecture series continues with talks on climbing Mount St. Helens and genetically-modified organisms. On Valentine's Day weekend, the planetarium welcomed harpist Ann McLaughlin to the dome for a special live concert.

The Cernan Earth & Space Center in River Grove will be receiving a new fulldome projection system in the first half of 2015, this the result of Triton College's decision to sell bonds to finance a wide range of campus upgrades and improvements. In September, the Cernan Center welcomed paleontologist and dinosaur researcher Scott Williams for a special members' event.



GLPA welcomed new members during its October conference at Ball State University, Muncie, Indiana. From left: Adam Thanz, Bays Mountain Planetarium; Anthony Dinch and Sandra Simpson, Edinboro University; Sara Schultz, Minnesota State University; Shannon Schmoll, Abrams Planetarium; Krista Thompson, Adler Planetarium; Benjamin Cabot, RSA Cosmos,

Dr. James Webb, Florida International University; Jeffrey Stark, Longway Planetarium; Sarah Komperud, Bell Museum, Minneapolis, Minnesota; Katy Accetta, Lake Erie Nature and Science Center; and Fred Huebener, Michigan Science Center. Right, top, Barbara and Gregg Williams (along with Dale Smith, not pictured) received the first-ever Mentor Award, a new GLPA rec-

ognition. Right, bottom: Debbie Schroer and husband Ron Schroer hold the Life Membership award and the Service Award posthumously awarded to John Schroer, who passed away on July 14, 2014. Ron is John's brother. To the right is Waylena McCully, William M. Staerkel Planetarium, who received GLPA's Service Award. All photos by Dan Goins.

Indiana. The Merrillville Community Planetarium sold solar viewers and held an observing session for the partial solar eclipse on 23 October. Although it was mostly cloudy, a few glimpses of the eclipse were seen.

In August, Evansville Museum's Koch Immersive Theater had a conversation with an astronaut when a dozen students chatted via amateur radio as the ISS passed overhead. Students from a local school participated, both in the planetarium and via Skype.

The Edwin Clark Schouweiler Memorial Planetarium, University of Saint Francis, Fort Wayne managed and hosted a Celebration of the Life of Chris Highlen on Sunday afternoon 16 November. Chris Highlen, the planetarium's Technician and Co-Producer since 2000, died suddenly on 16 October. (See page xx.)

Michigan. The Roger B. Chaffee Planetarium at the Grand Rapids Public Museum welcomed a new full-time staff member in late summer when Emily Hromi assumed her role as planetarium production technician. Ken Cott and his staff are also participating in activities surrounding the 20th anniversary of the Grand Rapids Public Museum's relocation to its current building and the 50th anniversary GLPA Conference in October.

At the Kalamazoo Valley Museum, Eric Schreur presented "Photographing the Night Sky" on Sunday 1 March.

Longway Planetarium welcomed Buddy Stark as their new planetarium manager. Richard Walker, the previous astronomy specialist, has retired from full-time duties, but is still assisting on a part-time basis. In addition, Executive Director Todd Slisher is excited to announce that Longway will finally be joining the fulldome community. It presented its last traditional shows on 31 December 2014 and

will reopen in late April of 2015.

The Vollbrecht Planetarium in Southfield offered a winter series of eight public shows presented by Cliff Jones. This year, guest speaker Robert Trembley presented NASA's plans for planetary and space exploration.

The Abrams Planetarium at Michigan State University is celebrating its 50th anniversary with exciting changes. First, it has welcomed Shannon Schmoll as its new director. Abrams has also retired its Digistar II projector after 20 years of faithful service. In its place, they have installed a Digistar 5 and a new ChromaCove LED light system.

The U-M Museum of Natural History has installed a fulldome version of NASA's Eyes on Earth. Also completed was the installation of DomeView Pro, which allows the staff to bring multiple inputs to the dome without diminishing computer performance. Several more NSF-funded fulldome clips have been completed and a few more are underway. Finally, the staff is saddened by the recent passing of Suzanne Goodrich, who made many of their planetarium upgrades and museum programs possible.

Ohio. A new exoplanets exhibit is open at the Boonshoft Museum of Discovery in Dayton. Cheri Adams and team have put a lot of effort into the design and funding of the exhibit and are excited to have it open.

Jeanne Bishop of the Westlake Schools Planetarium attended the Starmus Conference in the Canary Islands in late September. The festival featured presentations by scientists and astronauts that celebrated spaceflight and the exploration of the cosmos. A highlight for Jeanne was to meet Stephen Hawking!

Sue Batson reports from the Pittsburgh area that the North Hills High School Planetarium and the North Hills High School Astron-

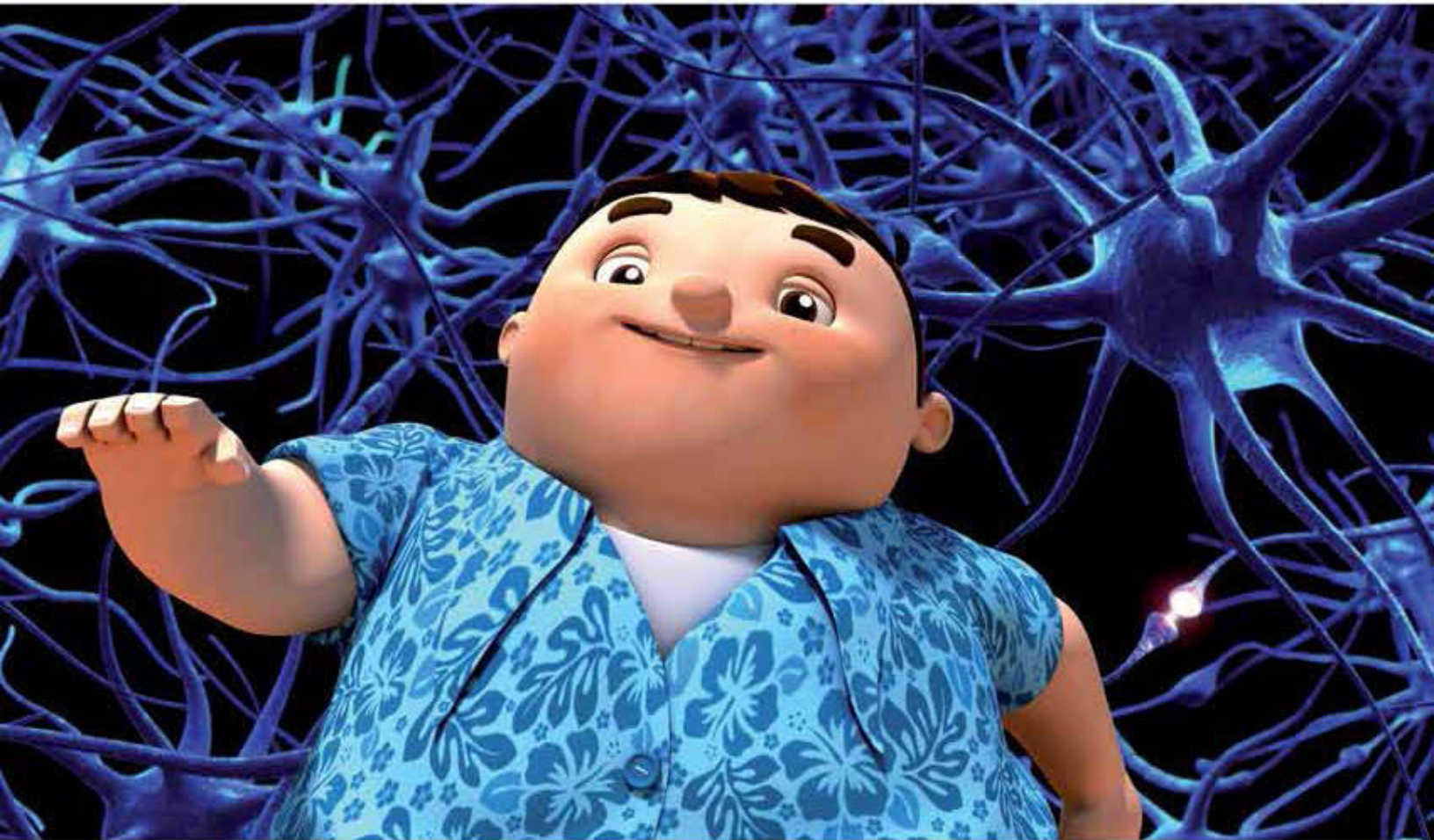


omy Club held a successful eclipse party on the baseball field at the end of the afternoon of Thursday 23 October, with about 150 people in attendance.

The Bowling Green State University Planetarium also ran an eclipse watch. The sky was 90-95% clear, but the 5-10% cloud cover per-



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versely lined up with the sun beginning a few minutes into the eclipse, so only early arrivals got to see the event.

Wisconsin/Minnesota. At the Minnesota State University Moorhead Planetarium in Moorhead, Minnesota, Dave Weinrich retired after more than three decades as planetarium director. Sara Schultz stepped in to serve as the planetarium coordinator for the next year as she and the Department of Physics and Astronomy work to justify keeping the planetarium open as a result of recent budget cuts across campus.

The Charles Horwitz Planetarium in Waukesha, Wisconsin presented a new home-produced program to the public, titled *Autumn Sky Legends*.

The Daniel M. Soref Planetarium at the Milwaukee Public Museum opened a new original show titled *Space Aliens: Looking for Life in the Universe* to accompany a new exhibit. It is creating another new show called *Cosmic Crossroads: A Journey Connecting Ancient & Modern Skies*, which supported the museum's new exhibit on the start of human civilization.

The Marshall W. Alworth Planetarium in Duluth, Minnesota just completed several successful live music events, as well as some school outreach events in collaboration with the Society of Physics Students at UMD.

The University of Wisconsin-Milwaukee Planetarium completed a series of Friday night shows, *Constellations of the Zodiac*, and will begin a program on *Terrific Telescopes* to celebrate the new huge telescopes being commissioned and the fascinating questions they help us develop and answer.

Rocky Mountain Planetarium Association

It has been a busy year at the Denver Museum of Nature and Science, keeping up with 175,000 visitors to its 125-seat digital dome. Fortunately they have a large visitor services staff and top-notch technical support to help keep up with 14 shows per day.

They are most excited about a couple of trial programs, specifically one called *Cosmic Cruisin'* and the other, the return of Laserium.

Cosmic Cruisin' is a 25-minute live show offered free of charge every day at noon. They have implemented some non-traditional practices for this program that have enhanced its success and opened the planetarium to broader audiences.

For starters, the show is free of charge. The planetarium doors are open and museum guests may walk in and out as the program continues. It is currently their most popular offering, averaging 80% capacity audiences, with few walking out.

The unique theatrical room lighting remains bright enough to allow for safe move-

ment in and out of the dome, but, more importantly, everybody can see the presenter, the stars and the rest of the audience.

After experimentation with different presentation models, they now use two skilled presenters for each show. One specialist remains at the console to fly SCISS Uniview software in real time, while the other interacts with the audience. They set the stage with a simple premise: where do you want to go? Predictably, the kids all yell out their favorite place.

The return of Laserium to the Gates during the summer of 2014 was a highlight. They went retro, blasting classic Beatles, Pink Floyd, and Led Zep while blazing classic Laserium imagery from their sophisticated projector.

They also brought in a classic Laserist Danny Nielson, who installed a brilliant solid-state beamer in front of the audience. The colors and forms from the beamer and mirrors surrounded the audience and added a tangible 3D framework, enhancing the lumina patterns on the dome.

The planetarium hosted 26 nights of near-capacity shows, attended by the laser enthusiasts of the seventies, now with their kids and grandkids.

A key to the Laserium success was billing this as a seasonal community event. The short run made access special and desirable, like the short run for a traveling Broadway show. The live performances created a concert atmosphere, complete with the black-lighted posters and hazer smoke billowing out of the doors of the planetarium.



RMPA: David Romero running Laserium at the Gates Planetarium. Courtesy of Dan Neafus.

European/Mediterranean Planetarium Association

The Eugenides Planetarium in Athens, Greece, celebrated the December Solstice with four free-of-charge screenings of E&S's digital show *Experiencing the Aurora*, an amazing tour to some of the coldest places on Earth to witness what is arguably one of the most beautiful natural phenomena on Earth.

On 2 February, the planetarium inaugurated the astrophotography exhibition of Theophanis Matsopoulos. Called *Between Earth and the Sky*, it is a stunning display of 50 photographs showing the star trails and the Milky Way over some of the most famous of Greek monuments, a selection of deep sky objects, as well as photographs of some of the astronomy instruments of the National Observatory of Athens.

The same event also included the first public screening of Matsopoulos's digital full-dome show, *A Voyage to the Universe*, which describes the structure of the Universe.

The Astronomical Centre Rijeka in Croatia (Rijeka Sport Ltd.) started its new program for 2015 with the film *Planets in Sight*, screened during the school holidays. In the end of January and as part of the national Night of Museums events, the centre prepared the special program *Inventions and Discoveries-Nikola Tesla's Universal Mind*. The program, which lasted for 7 hours, concluded after midnight and proved very successful, as more than 1,000 visitors participated.

In February, to celebrate Valentine's Day, the



EMPA: Birthday parties in Rijeka's planetarium have become very popular. Courtesy of Rijeka sport Ltd.



RPA: Top—Valentin Fedin, a retired engineer-lieutenant colonel and a veteran of space troops and cosmodrom “Plesetsk” from 1959 and a participant of 347 starts of rocket carriers, shared his memories in the Perm planetarium (Ural). Courtesy of Anna Kolesnik.



Center—Young refugees from Donetsk and Lugansk in the Nizhny Novgorod planetarium. Director Alexandr Serber is seen in the back. Courtesy of Vadim Belov.



Bottom—Boris Komberg reads his poetry in the small hall. Courtesy of Vadim Belov.

digital planetarium produced the *Romance Under the Stars* live show, dedicated to the night sky above Rijeka for that period of the year. Meanwhile, thanks to the variety of the planetarium programs on offer, birthday parties at the Rijeka Planetarium are becoming ever more popular.

In March, due to the partial solar eclipse visible from Rijeka, a new live show was being prepared for visitors older than 10 years old which focused on eclipses. The show illustrates how eclipses occur, the different types of eclipses and their frequency, and what are the best and safest ways to observe them.

Also in March, the center was set to celebrate the International Day of Planetaria with a selection of pre-rendered and real-time planetarium shows for all tastes and premiere its new live show, *News in Astronautics*. The show is an interactive live presentation introducing the latest achievements regarding the exploration of the objects in the solar system in 2015 using spacecraft.

Russian Planetariums Association

World Space Week was celebrated in different Russian planetariums, from Baltic Kaliningrad to Siberian Tomsk and Barnaul. A special new year 29th issue of the bulletin *Vestnik of RPA and Eurasian Concord of Planetariums* covering 15 pages was devoted to these events. They reflected the theme of the Week, which was 2014: Space Guiding Your Way.

Ufa. One of the most successful programs was developed by Ufa Planetarium, which included, in particular, the launch of a stratospheric balloon using satellite navigation to shoot panoramas of the city of Ufa and the atmosphere with subsequent demonstration of the obtained photo panoramas. There also were lectures about satellite navigation and quiz contests on space and satellite navigation before each session and a retro festival of science-fiction films.

Moscow. The large planetarium of Moscow celebrated on 7 November its 85th anniversary. This planetarium has a glorious his-

tory. It worked every day during WWII, and only once closed for two months for training of military pilots, navigators, and secret service agents. Schoolchildren also studied in the astronomical group, the Stratospheric Committee sat a few years here, and future cosmonauts were trained in astronavigation for 15 years, starting in 1960.

The cosmonauts Elena Serova and Alexander Samokutyaev gave their congratulations from on board the International Space Station, and the anniversary celebration was attended by many colleagues, including staff members of planetariums from Russia, Kazakhstan, and Ukraine.

Representatives of the scientific community were also present, and Boris Shustov, director of the Institute of Astronomy of the Russian Academy of Sciences, shared his thoughts about the future of Russian astronomy.

Nizhny Novgorod. Radio Russia reported on 4 September that a missile had hit the Donetsk Planetarium. Its director, Irina Filippova, answered that the shell hit the old planetarium, which had already been closed for a few years, and expressed her hopes for a speedy end of the war and the resumption of normal operation. She added that the planetarium continued the creation of new programs.

Surprisingly, the program developed by the “besieged” Donetsk planetarium, *Journey through the Solar System*, was a great success at the Novosibirsk International Multidome Festival on 26-28 September.

Filippova visited Nizhny Novgorod on 5 December, where she showed this program and shared her experiences.

The premiere of *Space Alphabet*, a new year full-dome program of the Nizhny Novgorod planetarium, was presented on 23 December. Its first audience was a group of refugee children from Donetsk and Lugansk.

Professor Boris Komberg, doctor of Physics and Mathematics, head of astrophysics of compact objects laboratory at Lebedev Physical Institute of the Russian Academy of Sciences (Moscow), also visited the anniversary of Moscow planetarium.

On 10 December he visited the Nizhny Novgorod Planetarium by a special invitation. His research interests are active galactic nuclei and the mysterious gamma-ray bursts. He gave the lecture “Galaxies and Their Active Nuclei” at the “oral journal,” the monthly Wednesday presentations titled We and the Universe.

Afterwards Komberg shared his memories of his famous teachers, Academicians Yakov Zeldovich, Andrei Sakharov, and others, and recited his poems. In 1999 he published the collected volume of his poems, *I Came to Life Armed with a Stock of Kindness*. His lines were set to music and have become the anthem of Russian astronomers:

*We are the only ones who watch the universes
fall and rise,
We are the only ones who know how stars end
their ways.
This everlasting knowledge makes us wise
And able to save our planet on troubled days...*

Society of the German-Speaking Planetariums

Vienna. Opening in 1889, the Natural History Museum Vienna is one of the most important natural science museums in the world. It is home to about 30 million collection items and, in 2014, welcomed about 650,000 visitors.

Although the building itself was not opened until 1889, the collections actually dates back to the year 1750, when Holy Roman Emperor Francis I Stephan of Lorraine purchased what was at the time the world's largest and most famous natural history collection from the Florentine renaissance scholar Johann von Baillou, thereby providing the foundations for the Imperial and Royal Court Cabinet of Natural Objects.

The museum is home to world-famous and unique objects, including the world's largest and oldest public collection of meteorites.

On the occasion of the museum's 125th anniversary, a new digital planetarium has been opened, featuring full-dome projection technology that will give visitors the chance to embark on fascinating virtual journeys in stunning scientific detail to the edge of the Milky Way galaxy or Saturn's rings.

Following the redesign of the meteorite and anthropology halls, the opening of the Digital Planetarium is a further step along the path towards modernizing the museum.

The Digital Planetarium, which seats 60 persons, comprises an 8.5-m inner dome (Spitz Nanoseam) and a larger sound-proof outer dome, set within one of the museum's historic halls. Two high-definition 4k video projectors located at the edges of the dome can be controlled from a console equipped with interactive systems or using a tablet computer.

The system uses the newest version of E&S Digistar 5 for all performances and Bowen Technovation audio and light systems. Overall coordination of the installation was done by Skypoint Planetariums, Italy.

In addition to live shows, a wide range of full-dome films on topics such as astronomy, biology, pre-history, paleontology, the deep sea, and more, in public shows and special school shows, are given several times a day. For information see: www.nhm-wien.ac.at/en. Contacts are: Christian Koeberl (director general, NHM Vienna), Gabriel Stoeckle (planetarium manager, NHM Vienna).

Cottbus. Since June 2013, the planetarium of Cottbus has used a new, modern projection technology: the star projector Cronos II from



GDP: Above—The new planetarium in the state-ly and beautiful Natural History Museum, Vienna. Courtesy of K. Kracher, NHM Vienna. Right, top—Puppets being filmed while acting in front of the blue screen, and below—the puppets in the final scene after chroma keying. Courtesy of G. Thiele, Planetarium Cottbus.

GOTO synchronized with the full-dome system InSpaceSystem from RSA Cosmos.

Producing planetarium programs has a 40-year tradition in Cottbus. But the new technology confronted the Cottbus team with new challenges, i.e. the production of full-dome videos by themselves lacking power and experience for sophisticated computer animations.

For the production of classical planetarium programs, the Cottbus team has already experimented with combinations of all-sky images (slides) and videos, with the videos directed by a programmable XY-mirror onto many points of the dome. These experiences are now used for the production of full-dome shows.

With the help of programmers from RSA Cosmos, the software was extended for the option of setting panoramic images at several levels in a short time. These drawn panoramic images serve as a background.

The acting characters of the show are recorded by video in front of a blue wall. They are represented either by puppets or real actors. Later, the blue background of the video is removed using keying techniques. This allows the video to be fitted into the scenes. Finally, the action can be combined with stars and other astronomical illustrations, which are included as 2D and 3D objects in the database of RSA Cosmos software.

Potsdam. The annual GDP conference takes place in the marvellous city of Potsdam, the capital of the state of Brandenburg 2-4 May 2015. Potsdam itself is located in a short



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NPA: Danish astronaut Andreas Mogensen meets children in Copenhagen. Courtesy Tariq Mikkil Khan.

distance from Berlin and can be reached by train (S-Bahn) within less than an hour. The conference sites are the Fachhochschule Potsdam (University of Applied Sciences) and the Urania Planetarium Potsdam.

The Urania Planetarium has a dome of 8 m, with 46 seats and a hybrid projection system, containing a ZEISS ZKP2 and a ZEISS Space Gate Quinto full dome system.

The planetarium was established in 1968, and since 2007 has been located in the famous Dutch Quarter in the city center of Potsdam.

The main focus of the meeting is the exchange of experience and knowledge among planetarians, vendors, and all persons interested in planetarium work. For more information, please visit www.gdp-potsdam.de or www.urania-planetarium.de. You might also want to contact the planetarium directly at planetarium@urania-potsdam.de.

Nordic Planetarium Association

In Denmark, focus will in 2015 be on space science because the first Danish astronaut will be launched on 1 September on a 10-day trip to the ISS. A large variety of events will take place both at the Tycho Brahe Planetarium in Copenhagen, the Steno Museum Planetarium in Aarhus, and the Orion Planetarium in Jels, including activities both for the general public and school groups and giving young and old a great chance to meet Andreas.

Many other science centres in Denmark also will take part in the project, which is supported by Lundbeckfonden and Nordea-fonden. For more information on Andreas Mogensen's mission and activities in Denmark visit www.rumrejsen.dk.

The next Nordic Planetarium Association Conference will be held at Heureka in Helsinki, Finland (see www.heureka.fi) Friday 4 September-Sunday 6 September and is open to all IPS members. Host Kai Santavuori can be contacted for more information. Invitations

and program were sent out in February, so if you are interested in receiving an invitation, please contact kai.santavuori@heureka.fi or aase.jacobsen@si.au.dk.

Italian Association of Planetaria

Infini.to is an interactive museum of astronomy and space with a modern digital planetarium, one of the most advanced in Europe. It is also a science centre with many interactive installations that allow visitors to experience and explore astronomical themes.

Infini.to will host the 30th Italian Planetarium Conference promoted by Planit. The meeting is open to everyone from 11-12 April 2015. The program also contains a fulldome festival on Saturday. Infini.to is located in Pino Torinese just outside Torino and can be reached by car or public transportation.

All the details of the National Conference are described at www.planetari.org.

During the meeting, the winners of the Planit prizes will be awarded. For the "To tell to the stars" competition, the contest rules encourages applicants to write a story that will be told under a planetarium dome.

The "Tell your experience" is a prize that honours communications presented at the national conference.

The Planit prize is for the main contest (500 euro), also open to foreign colleagues, that is devoted to a video about any astronomical or astrophysical subject. A duplicate of the winner's product will be shared with PlanIt members.

In the spring there are three other important astronomical events in Italy:

- 19-25 April 2015, Astronomy Week, promoted by the Ministry of Public Education and Italian Astronomical Society;
- 8-10 May 2015, Maddaloni (Caserta), National Conference of Italian Amateur Astronomers Union, more information at www.uai.it; and
- May 2015, Catania, National Conference of Italian Astronomical Society, more information at www.sait.it.

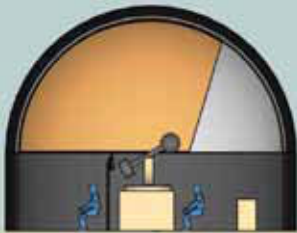
But the main Italian event will be the World Exposition in Milan, May-October. Two astronomical organizations have prepared a special itinerary among two cities called Astronomical Trails in Brescia and Perugia.



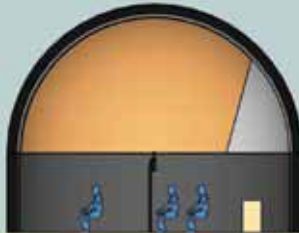
IAP: Left—Comet Lovejoy with the Pleiades. Courtesy of Luigi Cocca. Above—Comet Lovejoy through the telescope of the Serafino Zani Astronomical Observatory. Courtesy of Gianpaolo Pizzetti and Tarcisio Zani.

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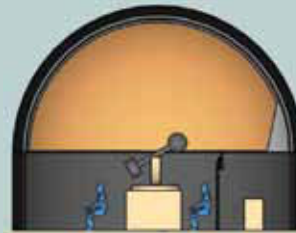
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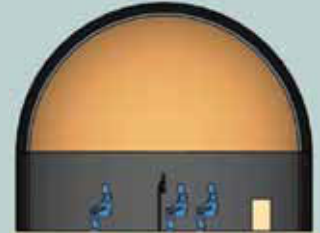
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– Matt Linke, University of Michigan Museum of Natural History Planetarium

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– Derek Demeter, Director, Seminole State College Planetarium, Sanford, FL



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APLF: North America nebula, NGC 7000. Courtesy of AIP president, Nicolas Outters.

Brescia is only one hour from Milan, and Perugia is located between Florence and Rome. More information is available from Starlight Association (mirusi7678@gmail.com) or Centro Studi e Ricerche Serafino Zani (osservatorio@serafinozani.it).

The new year started with the wonderful Comet Lovejoy, which drew a large audience in the public Italian observatories, like Specola Cidnea in Brescia, which is the first in Italy (established in 1953). Many photos have been collected. One of these, including the Pleiades cluster, suggest to us a planetarium vision.

In the last part of 2014 the StarLight Association ran workshops on the birth of constellations and their myths in collaboration with humanities teachers at the G. Pascoli middle school in Perugia. Each workshop lasted for about two hours. First the students had to work alone on a mute star map, and draw an imaginary constellation. Then they had to organize their drawings in groups of four and write a group story about their collections.

After that the StarLight staff explained the birth of constellations and showed those of today using the Mitaka program. At the end the students drew each real constellation near their imaginary ones on the star map.

Just before Christmas, StarLight also organized a performance for the general public titled "And a Light Appeared," dedicated to the Christmas star. The StarLight staff traced a chronological scientific path dealing with the principal hypotheses on the nature of that light; an actor, Claudio Massimo Paternò, read several passages from works by

Seneca, Tasso, Tycho Brahe, Kepler, and Pascoli; and three musicians, flautist Jana Theresa Hildebrandt, violinist Luca Maiolo, and cellist John Meshreky, accompanied the readings and slides with notes from Beethoven's Pastorale Symphony.

Association of French-Speaking Planetariums

A new collaboration is set up between the APLF and the AIP (Astro Images Processing, see www.astro-images-processing.fr/galerie.html). These French amateur astrophotographers produce wonderful images of nebulae, galax-

ies, stellar clusters, and more. Their images will be put inside a new AIP-Planetariums database with a precise identifica-

tion for each object. The constantly expanding database, open to every APLF planetarium, allows planetarians to use the photographs to illustrate planetarium shows and seasonal sky presentations.

The historical Observatory of Marseille, which receives about 20,000 people every year in its planetarium and exhibitions, has been equipped with new 3D projection equipment to accompany and diversify its offering of activities. For information contact: marie-france.duval@lam.fr.

In the region of Loire (Nantes, Laval, Le Mans, Angers, La Roche-sur-Yon, Fontenay-le-Comte), astronomical events were organized in 2013 and 2014 inside seven prisons. The preparation was long, but very constructive, thanks to the collaboration of the prison wardens with the planetarium moderator. Together they dreamt and used their imaginations and they will do it all again in 2015. For information contact: jerome.galard@fal53.asso.fr.

From 19-21 December, the 8th LSS Workshop mixed with a mini conference for small planetariums was held in Marseille, joining together 31 people from the four corners of France and also from Belgium, Switzerland, Italy, and Spain, in order to reveal the latest planetarium shows, latest innovations in terms of display of full dome in real-time and best numerical software of data processing for the domes. Contact: lionel.ruiz@live.fr for more information. ☆



APLF: 8th Workshop session for small digital planetaria, December 2014. Courtesy of Lionel Ruiz.

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The IPS Education Committee

The Education Committee has been preparing questions to learn about student planetarium programs and astronomy teaching at different levels in different countries. Soon we will have a survey online to be completed by someone at each planetarium and also guides for gathering information. An archive of planetarium education practices and school requirements is our goal.

What is education?

At the suggestion of committee member Tomas Graf of Planetarium Ostrava of the Czech Republic, we realized the necessity of identifying what we mean by education, and then, specifically, need a working definition of planetarium education in student programs.

There are many definitions and discussions of education and learning. Every teacher-training textbook has a definition or a perspective. A survey of quotations about education shows that the terms have been interpreted in widely different ways throughout history, in different cultures, and by different prominent individuals.

Often a statement is a philosophical pronouncement. Sometimes the importance to society is emphasized, or the words indicate experience and/or suggest action. Here are a few brief statements from notable sources that sample the variety of interpretations of "education":

- "Education is more than a luxury; it is a responsibility that Society owes to itself." Robin Cook
- "Learning is the only thing the mind never exhausts, never fears, and never regrets." Leonardo da Vinci
- "Education is the best provision for old age." Aristotle
- "You can teach a student a lesson for a day, but if you can teach him to learn by creating curiosity, he will continue the learning process as long as he lives." Clay P. Bedford
- "Tell me and I'll forget. Show me and I may remember. Involve me and I'll understand." Chinese Proverb
- "Education costs money, but then so does ignorance." Claus Moser
- "Education is what is left after one forgets



everything learned." Unknown author

- "Education should consist of a series of enchantments, each raising the individual to a higher level of awareness, understanding, and kinship with the universe." Unknown author
- "I am still learning. I am always learning." Michelangelo

The best discussions of education and learning I have seen appear in the book *Visible Learning and the Science of How We Learn* by John Hattie and Gregory Yates (Routledge, London and New York, 2014). Educators Hattie and Yates are from Melbourne, Australia, and take an in-depth journey through the literature of social and cognitive psychology to bring understanding to what goes on in the process of education. Some main principles or conclusions they reach are:

- We naturally learn from exposure to information detected by our senses. But to increase our knowledge base, this information has to possess a level of organization which matches how our minds are structured and organized—and our minds change in how we structure and organize as we age.
- When our mind's limitations are reached, deep and meaningful processing becomes impossible, and only shallow learning will occur from this point.
- Human learners benefit enormously from social examples, from directed instruction, and from corrective feedback.
- Within both public and professional domains, fallacious ideas of human learning continue to be promoted despite being contradicted by available scientific evidence and opinion.

I want to share more of what Hattie and Gregory have to say in a future issue of *Planetarian*, but now let us turn attention to a

construct of education that can be applied to school planetarium programs. Education takes place in almost all planetarium programs, but in this project we will focus on programs for student groups.

Planetarium education

We hope to identify the information and methods used to reach positive outcomes with students in planetariums worldwide, and we hope to learn the astronomy and related subject information required, especially those requirements that impact the preparation of planetarium programs.

With my own experience as both a planetarium teacher (a school planetarium director) and a classroom teacher, I conclude that there are several aspects of the educational process that are very important in any setting.

First is the transfer of knowledge. Second is the development of skills. Third is the increase in enthusiasm for a subject—enthusiasm that will result in the student wanting to learn more on his or her own. Planetarium programs for students can and should do all of these well.

Excellent visual spatial experiences possible in a planetarium help students learn concepts difficult to learn in a classroom, with books, or with a flat screen. If discovery, role-playing, modeling, movement, and questioning are included in a planetarium lesson, skills of critical thinking and creativity can be developed.

I have been doing participatory programs for many years, and I know that many others, particularly those with portable planetariums, have also been giving such programs.

Perhaps the third aspect, the one of motivating and inspiring the student, engendering enthusiasm that will transcend the mechanics of learning information or skills, is the most important of all. Planetariums, with their novel spatial environments, have the potential of motivating, inspiring, and imparting enthusiasm in wonderful ways.

So we come to a working definition or description of planetarium education: the topics and methods included in student programs to develop knowledge, skills, and motivation to learn more and the resulting understandings, skills, and enthusiasm for the topics.

Influences by other experiences

Since a planetarium program in a museum or science center often is combined with other experiences, we will want to know about these experiences as well. Multidiscipline programs for students that emphasize history, physics, biology, chemistry, geography, mathematics, language, or art are offered by some planetariums. Information about programs or special preparations for students who are deaf, blind, mentally handicapped, or disabled in other ways also will be helpful.

(Continues on page 56)



DOWN TO EARTH

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Under the Weather



March 2015

Planetarian



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Special training or in-service programs for planetarium personnel and experiences for groups like astronauts or historians (all “students” in the planetarium) should be described. Additionally, the archive will be helpful if planetariums can supply information about school-planetarium interactions, such as teacher participation in program design. Look for information soon on how to complete the survey.

More planetarium research ideas

Planetarium research is another main interest for the IPS Education Committee. In the last “Seeking What Works,” committee members Ka Chun Yu, Shannon Schmoll, and I shared some possible topics for learning in planetariums.

Below are comments from Julia Plummer, associate professor of Science Education at Pennsylvania State University and also an Education Committee member and a star planetarium researcher, who offers further planetarium research ideas.

(See, for example, “A Longitudinal Study of Early Elementary Students’ Understanding of Lunar Phenomena after Planetarium and Classroom Instruction” which she co-authored with Kim Small in the December 2014 issue of *Planetarian*. -ed.)

“One area that I have wondered about is the extent to which the planetarium programs produced (or delivered live) attend to what research has shown to be effective in multimedia learning. For example, Mayer and Moreno (2003) point to the challenge that cognitive load places on multimedia learning and offer suggestions for ways to reduce cognitive load in multimedia learning.

“It would be interesting to evaluate current planetarium offerings in terms of how well or poorly they consider issues of cognitive load when engaging audiences. This topic transcends the size of the planetarium or whether it uses optical-mechanical or fulldome technology.

“Another idea that has interested me is how planetariums can engage audiences socially. In the National Research Council Report *Learning Science in Informal Environments*,¹ you see a strong emphasis on the social aspects of informal science learning. We now understand that learning is a social process.

“But planetariums are not necessarily de-

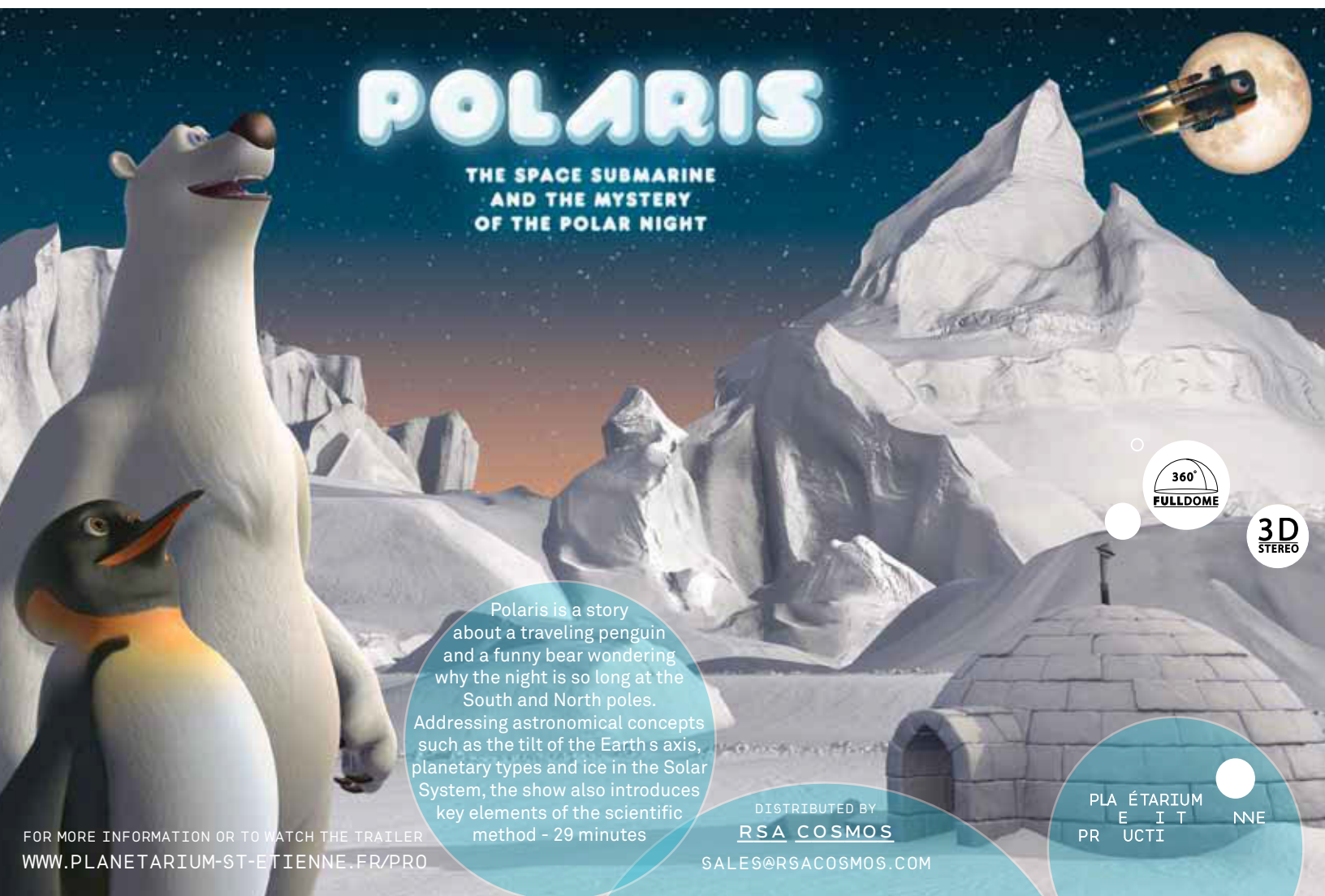
signed to engage visitors socially, such as through conversation, group problem-solving, or shared connections to prior experiences. In programs that are using social engagement, how does this support learning? Are there methods we can investigate that would impact learning by emphasizing social aspects? Do families reflect and engage further about the content of a program after they leave the planetarium?

“I have found that engaging children in using gestures that mimic the motion of the sun, moon, and stars helps them learn this apparent motion in the planetarium. Can other types of directed gestures or motions in the planetarium also support learning?

“In the *Framework for K-12 Science Education*² (the Next Generation Science Standards in the US), three-dimensional learning is described. I am wondering if students can engage meaningfully in a fusion of a core disciplinary idea, a science practice, and a cross-cutting concept in a single planetarium program.” ☆

¹ *Learning Science in Informal Environments: People, Places, and Pursuits*, published in 2009 by the National Academies Press. You can download a free pdf of the book from the NAP website: www.nap.edu/catalog/12190/learning-science-in-informal-environments-people-places-and-pursuits.

² *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*, was published by NAP in 2012. This work also can be downloaded at www.nap.edu/catalog/13165/a-framework-for-k-12-science-education-practices-crosscutting-concepts.



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African struggle to join the planetarium community

Anthony Kuria (tonidaokabs@gmail.com), from Uganda, is still looking for help. As I wrote in December, he wants to start an educational outreach program for schools within the East African region with a portable planetarium, a telescope, and binoculars.

He has searched and compared the pricing from major planetarium manufacturers and he thinks STARLAB suits his purposes. He writes that the major challenge is the pricing, since no educational cooperatives exist and no corporations support or fund science and technology there in Africa. He is enquiring after a second-hand planetarium or an old one that can be refurbished. He is also seeking the possibility of a donation from a museum or a planetarium organization and advice on how to pursue that.

In his latest note, he exclaimed "To me this now appears more than just a dream, I look at this project with a lot of enthusiasm and am writing a curriculum based on notes from your handbook (IPS Portable Planetarium Handbook, published in 2002) and STARLAB and other internet sources. I have started to prepare a budget. I believe that this will bring the greatest exposure with hands-on activities for kids and others who have never had the experience of a planetarium. I thank you once again for making it a step closer to realization."

Please contact him with any thoughts you may have to assist in making this dream come true! Meanwhile I am keeping my eyes peeled for used planetariums and writing inquiries. I know there are many portable planetariums unused and sitting forgotten in closets.

Portable planetarium productions

This month Rachel Thompson (rachel.thompson@perotmuseum.org) contacted me. She wrote, "I have a question regarding portable planetariums and would love your advice (if you're okay with sharing it). At work I was recently asked if planetarium productions might be something we could sell outside of our institution to other portable planetarium users. I have a few really strong opinions on this, but would like to know what you think

and if you have had any experiences with vendors that specifically target this group."

I replied that her institution could, of course, sell shows to portables if the price were right for small budgets. As far as I know all the show producers have something priced for portables, but the prices are still quite high. The one most targeted to interactivity under the dome is Joanne Young with Kim Small's input.

(www.av-imagineering.com/the-moon-a-module-planetarium-program).

I do not like most movies in portables because seeing things moving fast and furious in such a small venue can make you sick and distract from the content!

I do not think movies are the best use of the venue. Some people try to promote interactivity by breaking shows into modules (Kim Small has done some research on the effectiveness of modular shows and thus far it look good; see ksmall@uds.org.) Some try interactivity by just stopping the show one or more times and having a discussion or an activity.

Either way, I think is better than sticking kids in front of a movie, especially in a portable. That's my two cents!

Oh, and of course, STARLAB has created lessons using the digital projector and the software Starry Night. I like that idea, too.

Rachael responded, "I completely agree with your two cents—the one movie we show is good, but...it's not nearly the experience the same-age students have when they request a live show. I am really interested in Kim Small's work... And I'll check out STARLAB's site.

"It is a great topic to explore. My own 'strong feelings' are that the portable planetarium is much more an interactive lab than a bigger dome is. The content presented in both can be the same (the visuals can even be similar...though different speeds!). But the approach is going to be different. A portable is a much more intimate setting—one that speaks to interactivity and student involvement in the show. Having the kids just sit there is... weird.

"In regards to selling shows, I believe there is a lot of free content that works very well in the portable planetarium. With this content

out there, I find it difficult to imagine a real profit could be found in marketing materials to portables, unless the price point was very, very low (\$30-50 a clip). So many portables are in schools...and they have zero budgets for new program material. The price would either have to be free (woohoo!) or very small so that an individual could purchase something they wanted for their dome. If there was a great clip that I could find that I could pay 20 bucks for...I'd create a wishlist!

"I haven't asked around much. But I did check with the staff here at the Perot Museum of Nature and Science (a few of whom have been involved in the planetarium world outside of here). We seemed to share similar opinions...We're fortunate to have a really great staff!"

If you are of the same mindset—that interactivity is best in portable domes—and are looking for some free materials to create your own interactive portable planetarium lesson/show, remember to visit the Resources section of the IPS's website (www.ips-planetarium.org/?page=resources), where you can find links to free media, the Portable Planetarium Committee, and the Yahoo Group for small planetariums.

You also can go to Resources>Live Interactive Shows (www.ips-planetarium.org/?page=lips) for even more resources.

Pages of Stars

This year began a call for planetarian colleagues from around the world to prepare a short recording and text, in English, that can be used under a planetarium dome. The text can be:

- an astronomical and scientific commentary,
- a classical Greek (or another culture's) sky story or
- an original story or a poem (any kind of topic) with some astronomical details or with an event that happens under the night sky (including the name of some stars or constellations or other sky objects visible with the naked eye)

This year we received only two submissions and will post them online in the Free Media space on the IPS website. (Resources>Free Media, www.ips-planetarium.org/?page=freemedia).

"The Rabbit in the Moon" by Andy Kreyche (akreyche@hartnell.edu) in the United States; Andy adapted this story from several versions of a Japanese folktale.

"Introduction to the Planetarium" by Oded E. Kindermann from Argentina; Oded's script is part of an introduction that he uses for his shows when he works with children from 4- to 6-years old. His goal is to calm the students while they are waiting in front of the plane-

(Continues on page 66)

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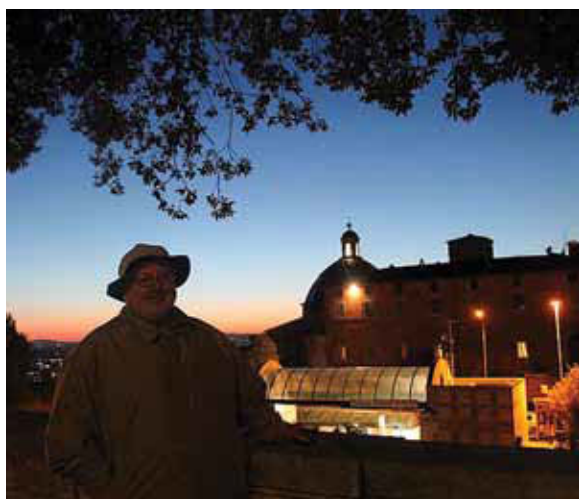
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American in Italy Report

The amare of springtime in Italy



By Dave Weinrich
Recently retired planetarium director
Minnesota State University
Moorehead, Minnesota 56563 USA
dave.l.weinrich@gmail.com

Italy in the springtime. Ah, what's not to love! In the spring of 2014 I was privileged to participate in the annual "Astronomical Experience in Italy for an American Planetarium Operator." Transported from the wintry landscape of northern Minnesota to an amazing Italian adventure, I truly did experience "la dolce vita!" Although I had been to Italy before as a tourist, this time I was welcomed into a warm fellowship of Italian families and friends.

When visiting another country, one must be prepared to leave their cultural baggage at home. There will be different ways of doing things, different foods, and perhaps a different concept of time. A sense of adventure is required and one must be prepared to go with the flow and to adapt as necessary. It is important to fully participate in the experience and, as they say, "when in Rome do as the Romans do."

My itinerary took me to three cities: Gorizia, Brescia and Assisi. I had the opportunity to deliver lessons and planetarium shows to students, lead a teacher workshop, and present public lectures. I attended the annual meeting of the Italian Association of Planetaria in Modena. Some of my new Italian friends took me sightseeing and I visited Venice, a city which had long been on my "bucket list."

I developed three presentations—one for students, one for the public, and one for a teacher workshop. The theme was "Your Personal Connection to the Universe." Photons of light, created by nuclear reactions inside stars, travel through space for many years to reach the Earth. When you see a star, some of those photons end their long journey on your retina, and are converted into electrical impulses that travel to your brain. Hence, there is a connection between you and the stars that you see in the night sky.

The presentations for all three audiences started the same. Loris Rampogni, the originator of the Italian Experience, had suggested that I bring a dozen images that told something about me, my local area, and my planetarium facility. This added a personal touch to each talk and, judging by some of the student comments, was of great interest to the audience.

The student lesson varied somewhat depending on the facilities available at each site, but in general included the following: building and learning to use a simple planisphere, a planetarium night sky tour, a constellation myth about Ursa Major, and a demonstration of parallax with a discussion of how it can be used to determine the distance to stars. The lesson concluded with a video from the American Museum of Natural History depicting a journey from the Earth to the limits of the observable universe.



Top: The author in Assisi, Italy; photo by Simonetta Ercoli. Above: The "Luna Piena/Full Moon" sculpture in Venice; photo by author. Below: Food, wine, and good fellowship with members of Circolo Culturale Astronomico Farra d'Isonzo. Luciano Bittesini, at far end of the right side of the table, is the local organizer for the Italian Experience. From left, around the table: Enrico Pettarin, secretary; Franco Piani, vice president; Ottavia, Franco's wife; Bittesini; Dave Weinrich; and Franco Bressan. Photo by a passing volunteer.

The public presentation was similar, but since Italy has many famous art museums, it started by comparing an original work of art to a copy. Obviously, there is a reason why people want to see the original masterpieces. Likewise, everyone can go outside and look at the real sky. There you can see the actual light from celestial objects. Even in a large city, you can still see the moon and the brighter planets. The public lecture concluded with the Voyager picture of the Earth as a “pale blue dot” and the words Carl Sagan wrote about it.

The teacher workshop asked the question “How do we know what we know?” People may know the distance to the sun, or at least they can look it up, but how is it measured? It all started with Eratosthenes measuring the size of the Earth. Teachers were given a simple method for their students to measure the Earth’s radius using nothing more than a stopwatch and a meter stick. Once one knows the size of the Earth, one can ascend the “cosmic distance ladder,” out to the limits of the observable universe.

And so, at the end of March, my Italian Experience began. I arrived at the regional airport near Gorizia, after a magnificent sunset flight over the Alps and was enthusiastically greeted by my local host, Luciano Bittesini. Arrangements had been made for me to stay at the home of a local astronomy club member, so dinner was waiting and they were eager to practice their English with me.

Early-morning musings

The next morning I awoke early. It was still dark so I, as any good planetarian would do, stepped outside to look at the sky. Here’s what I wrote in my journal that Tuesday morning:

“Here I am in Italy! I was just outside, listening to the birds sing and getting my connection to the cosmos. It’s incredible to see Mars in the land where the name originated, also on the day of the week named after it [Italian Martedì ... There is the big dipper and “arc to Arcturus and spike to Spica.” Even though I am thousands of miles from home, I see the same stars and feel connected to the universe. Just imagine, Arcturus is 37 light years away!”

I did some quick calculations and realized that the light I was seeing at that moment had left during the summer of 1977, which coincidentally was the first time I visited Italy. I referred to that ear-



Top: The observatory (left) and planetarium (right) at the Circolo Culturale Astronomico Farra d'Isonzo. Center: This is one of the first sundials built in the village of Aiello del Friuli. On the right is Franco Bressan, a retired mathematics teacher. Both photos by author. Next: There are many excellent telescopes used by amateur astronomers in observatories across Italy. This one is at Osservatorio Serafino Zani near Brescia. Bottom: The Mount Subasio Amateur Astronomers Society has constructed several telescopes at their observatory near Assisi. Left to Right: Luca di Bitonto, Abdelhalim El Hilali, Dave Weinrich and Daniele Capezzali, a researcher at Monte Porziano Observatory. Photo by Simonetta Ercoli.

ly morning experience in my presentations during the next two weeks as an illustration of how far away the stars really are and reminding audiences that Arcturus is one of the closest stars to us.

The next morning, Luciano picked me up and we drove several kilometers to the Circolo Culturale Astronomico Farra d'Isonzo (Astronomical Cultural Club of Farra d'Isonzo). I think that its observatory and associated planetarium probably hold the distinction of being the only such facility located in the middle of a vineyard! The sounds of tractors and other agricultural equipment could be heard at times during my presentations.

Amateur astronomy appears to be flourishing in Italy. In each of the three cities I visited observatories operated by local clubs or associations. I was impressed by the skill and dedication of the astronomers, many of whom had built the telescopes and written the software that controlled them. The facilities, which were used for both scientific research and public outreach, often included a planetarium or an auditorium, which enhanced the programs that they could present to their visitors.

A flurry of presentations

During the next four days, I gave presentations to high school classes and delivered a public astronomy lecture. One of the school groups, as well as the public lecture, started at 9 p.m., considerably later than the time that I would begin a program at home. No problem! After all, adaptability is one of the keys to having an enjoyable cross-cultural experience.

There were several opportunities for sightseeing. One day, one of the local astronomy club members, a retired mathematics teacher, took me to Aiello del Friuli, the “village of the sundials.” As a teacher, he had been looking for a way to teach his students about conic sections. He decided that an ideal method would be to use sundials.

With the aid of the school custodian, the first sundial was made about 40 years ago. The idea caught on and soon other village residents started building their own solar timepieces. Current-

(Continues on next page)

ly, there are some 200 sundials in the town and every summer they have a special festival. There is a competition to judge the best sundial built during the preceding year and a band leads people through the streets to view the new sundials. This endeavor is a wonderful example of getting the local community involved in the educational activities of its schools and, in the process, popularizing astronomy!

After Gorizia, it was time to move on to Brescia, but since there was a school break, I was able to spend several days in Venice, the famed “Queen of the Adriatic.” The easiest way to get around Venice is by vaporetto, or “waterbus” These boats carry several dozen people and stop at predetermined points around the island.

The moon in blue

On my first night in Venice, at the vaporetto stop next to the Piazza San Marco, I had another astronomical experience. I noticed a stunning glass sculpture, a large sphere with smaller spheres within it, and lit by a pure blue light. It was named “Luna Piena” (Full Moon). The sphere duplicates the phases of the moon. Its creator, sculptor Judi Harvest, describes it as follows:

“Luna Piena embodies the magic of the universe and is a warning to be more aware and loving with our environment. The universe continues to inspire and surprise us—art may imitate life, and occasionally transcend it.”

It was a fast train ride from Venice to Brescia. Waiting at the train station, Loris Ramponi welcomed me to his city, my next stop on my Italian Experience. I had some time at my hotel to unpack and freshen up, before he and his daughter Anna, a university student in Verona, came back to collect me. Now it was time to experience an Italian grocery store and to buy the ingredients for the evening meal. It was enjoyable to observe the everyday aspects of Italian life.

In Brescia, I worked in a STARLAB portable planetarium in a noted school at Liceo Scientifico di Stato A. Calini. The portable was set up in the school library and more than one student was surprised when they saw this “strange” device in their familiar library. I gave several presentations to a variety of English classes over the next three days. After each lesson, Loris recorded student’s reactions. They had to make their comments in English. I found the comments helped me to gauge the effectiveness of my presentations and was gratified that some of the students found the

Top: Eager students, with planispheres in hand, are ready for a lesson in the portable planetarium in Brescia; Below, Students in Assisi construct planispheres. Photos by the author.



experience inspiring.

“I’ve never really been interested in looking at the real sky, but after this experience, I think that I’ll watch it sometimes.”

“I have no words to explain how interesting the experience was. Beautiful!

Meeting with Planit

Now it was time for the annual meeting of the Italian Association of Planetaria, which this year was held in Modena, “the capital of engines,” noted for being the home of the Ferrari supercar, the birthplace of Luciano Pavarotti, and the production of the highest quality balsamic vinegar.

The meeting lasted for a day and a half and was similar to other affiliate meetings that I have attended. There were papers, sessions in the planetarium, and vendor demonstrations. I had the opportunity to give a short report about myself and my experience in Italy. A special treat was a presentation at a nearby villa by a portable planetarium vendor, complete with an alfresco lunch in the courtyard. The Italian planetarium group is small enough so that on Saturday evening we were

all able to gather in a small local restaurant to have a meal together. It was like being part of an Italian family reunion! On Sunday afternoon there was time for some of us to do some sightseeing in the central part of Modena.

Assisi: The final stop

After the Italian meeting, I traveled with my next host, Simonetta Ercoli, to Assisi, the last stop of my Italian Experience. It was a spectacular trip of several hundred kilometers, via an expressway, driving past Bologna and then through the Apennine Mountains to Assisi, a noted pilgrimage site. Here I did my teaching at a boarding school, Principe di Napoli Assisi. The headmaster was on leave so I stayed in her apartment and took my

meals in the school’s cafeteria. We did not have access to a planetarium, so I taught the lessons using the planispheres that the students constructed in class, also using an astronomy application on my iPad and a PowerPoint presentation. It was interesting to walk among the students as they assembled the planispheres and to ask them questions.

There were ample opportunities for sightseeing in Assisi and Pe-

rugia as well as a nighttime visit to the Porziano Observatory. How can I forget the night that we were at the observatory? A beautiful full moon was rising over the mountains and lighting up the Italian countryside. There were also many other attractions in both cities and I won’t soon forget walking up and down the hills!

All too soon it was time to head back to northeastern Italy and prepare to return home. A six-hour train ride through Florence, Bologna, Padua, and Venice brought me to the small town of Monfalcone, where I would catch my flight back home the next day. Luciano stopped by to chat and we went to a small pizzeria, a fitting end to my adventures in Italy.

If you have a sense of adventure and want to have a great experience in a rich culture, where you will be warmly received by fellow planetarians, I would encourage you to apply to this program or to take advantage of visiting our colleagues in other parts of the world. We all have much to learn from each other and together we can continue to reach for the stars! ☆

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"Help Me...I'm Surrounded, Part 1"

Stereo. 4-channel. 5.1. Dolby Pro Logic. 10.2. Spatial Sound. 7.1. Atmos. The systems seem to go on forever, and I have had opportunities since 1985 to either design most types (formats) of planetarium and exhibit audio systems or to compose and design soundtracks for these systems.

There is some confusion as to what these systems really are, what they sound like, and how you produce for them.

Why use surround sound?

Say "surround sound," and the image it evokes is sound all around you, of course. But to fly sounds around the room? No. The "surround" part is most important to create space between audio objects. The more sound elements you jam into two stereo channels, the more confused the overall sound becomes and the less separated and/or distinct.

A nice side effect of this "spatialization" is that you can also place sounds in spatial locations in the room that mimic where they would be heard from in the real world. This is known as "imaging."

So, rather than hearing evening crickets or crowd conversation from only two speakers, in surround you would hear these spread out from all direction, more like they would be heard in the real world. By spreading these out, you create space or "air" between the sounds and they become more clearly heard.

In music, a cool surround sound hi-def audio format is SACD. Many SACD discs are now coming out and these often feature 5.1 remixes of the studio recordings. Listen to the stereo

CD version of Dark Side of the Moon and then the 5.1 SACD of the same songs. Stunning.

Localization

With all-dome video you can place (localize) the voices of on-screen characters to match where the characters appear on the screen, rather than having all the voices coming from one or two speakers. Let's face it... when you hear three voices in conversation, they don't all come from the same point in the room.

Michael Daut (E&S show producer) states, "when used dramatically, musical instruments or voices can pan through the 360° space to track objects on screen, and sound effects in the soundtrack can enhance the "off-screen" space behind the audience to intensify earthquakes, volcanic eruptions, severe weather, or even the business of a city at work. Surround sound is a vital tool that can powerfully orient the audience inside of the experience, completing the illusion of immersion. After all, the sense of immersion is the uniqueness and power of fulldome." What do I need for surround sound?

The table shows that the necessary parts of the audio "chain" for the most popular surround sound arrangements. There are basically four sections in an audio system.

Stereo. First, a look at stereo 2-channel audio in a dome with unidirectional seating. If your show audio is stereo, this is what you have. Of course, you have two main speakers in the front of the audience, and you might have two more in the rear. This helps fill the seating area with sound, but isn't really sur-

round sound; the audio is stereo in four speakers.

Your front and rear speakers might be on the same amplifier channels, which makes the volume level the same in all four speakers.

It helps to have the rear speakers on a separate amplifier so you can reduce the rear sound level. This keeps the audience focus to the front of the dome. And you might have a subwoofer with "crossover" and a separate amplifier (or this subwoofer might be a self-powered unit with a built in crossover).

But now let's take those four speakers and work a little magic.

Adding 5.1. Lets add a "center channel" speaker and a subwoofer. Then add enough amplifier channels to have each speaker on its own amplifier channel. Then add an audio processor with at least 6 outputs (L-R-C-Sub-Ls-Rs) and at least 6 inputs (see my Sound Advice from Spring 2014 for details). If the show audio is in 5.1, you've got it! If not, you can program your audio processor to route stereo audio channels to all the speakers. This at least fills the room with sound.

7.1. Time to bust a myth. I have designed many 7.1 systems. 7.1 is not a better format than 5.1, it is just a different format. If the show has been produced in 7.1, you will benefit from the extra two channels. If not, you probably won't. However, with the proper audio processor you might be able to route some of the Ls and Rs audio from a 5.1 soundtrack to the side speakers just for "fill."

You need to be careful, however, that you do not ruin the stereo and rear imaging the show producer created in their mix. If you are producing your own soundtracks you can create some great effects with the 7.1 channels, but most of the shows you purchase won't have 7.1 audio.

3D Audio. In recent years two object-based 3D immersive formats have surfaced. One is from Fraunhofer Institute (licensed by Barco and Shure as well), and the other is Dolby Atmos. These formats have many advantages over 5.1 and 7.1

Atmos is already installed in over 700 cinemas as an international standard and is Dolby's new-generation surround sound. The consumer version is being built into home theater receivers at the time of this writing and most films are now mixed in Atmos. I am sure there is a theater near you where you can experience Atmos.

New Blu-ray movies have Atmos, 7.1, 5.1, and stereo mixes all on one disc.

The Fraunhofer 3D sound format (Spatial
(Continues on page 67)

	Audio Channels (tape, hard drive, computer file, video server, etc)	Processor Inputs and Outputs*	Amplifier Channels (Minimum)**	Speakers	Channel Names
Stereo	2	2-4	2	2-4	L-R front, L-R rear
5.1	6	6-8	6	5+ Subwoofer(s)	L-R-C-Sub- Ls-Rs
7.1	8	8-10	8	7+ Subwoofer(s)	L-R-C-Sub-Ls-Rs- Lss-Rss

* The number of processor inputs varies with the exact system design, such as whether there are ALS channels, aux devices, etc., and if the system is bi-amplified.

** The number of amplifier channels varies dependent on whether the system is bi-amplified, for example

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*A Student's Guide to the
Mathematics of Astronomy*

Daniel Fleisch and Julia Kregenow, Cambridge University Press, 2013

Reviewed by Francine Jackson, University of Rhode Island Planetarium, Providence, Rhode Island, USA.

Because we normally spend so much time in the dark teaching our favorite subject, we often tend to forget that much of astronomy is mathematical. This is why it was good to see Daniel Fleisch and Julia Kregenow remind us of this in their small, but packed, book. *A Student's Guide to the Mathematics of Astronomy* brings us back to class with relevant information on gravity, light, stellar motion and magnitude, and cosmology.

For someone like me, who hasn't had to think of astronomy as a mathematical subject in a long time, this book was really interesting. The concepts were a good review, especially as the book itself is aimed for the non-science major (read "no calculus"). Each chapter introduced the topic at hand, then went through sample questions step by step. Also, for anyone interested, if the material should prove a bit tricky, there are helpful podcasts to supplement the written material.

My only real criticism of this book is that the answers to the questions at the end of each chapter aren't at the end, in an appendix; instead, we have to go to a related website to check our work, something that I don't have

much time for.

Despite the fact that we couldn't readily check our work, it was very nice to have these topics, and questions, in a small, easy-to-read book, one that can be easily carried. The under-200 pages were perfect for a quick reference for anyone wishing to have relevant astronomical topics at our fingertips, even if we are trying to read them in the dark.

Urban Astronomy: Stargazing from Towns and Suburbs

Robin Scagell, Firefly Books, Ltd., Buffalo, New York, 2014

Reviewed by Francine Jackson

Unless we're fortunate to be living in an area relatively comparable to a planetarium sky, our city environment isn't very conducive to enjoying the true beauty of the night. Robbin Scagell, in his fairly short book *Urban Astronomy*, reminds us that we don't have to truly despair, that there is enough to view even in a light-polluted area.

Scagell does give a lot of time to the problem of lighting, including the progression of streetlights from mercury, to sodium, to metal-halide, with, of course, many pictures of both good and horrendous examples of city streets. He also gives us advice on positive action, such as going to city/town legis-

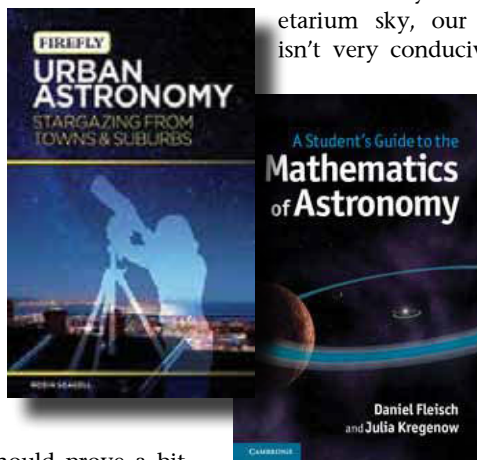
lators, and hopefully getting a sympathetic ear. Barring that, he does mention that using binoculars or smaller telescopes, although not what many of us hope for, are fairly good for high-*it* regions.

He also takes weather into consideration, as well as living in high-rise apartments; in fact, Scagell shows that a balcony can be useful for city skygazing. But, of course, the normal observing problems are still there, so he puts in a few pointers:

- **Leave.** Find an island paradise, one that isn't already swarming with tourists;
- **Drive.** Determine fairly dark areas within driving distance;
- **Remote.** Become part of the network of remote observatories being offered. Although the actual set-up-and take-down fun is lost, many of these observatories are worthwhile for frustrated, citybound observers;
- **Filters.** Buy filters that can block out at least some of the unwanted effects of neighboring light.

Scagell geared this book for the newer amateur, a person who is just being introduced to the wonders of the night, and the inherent problems now facing the serious observer.

It appears to be written so that anyone who picks it up and looks at it will be both amazed at what can be done in a city sky, and given a primer on what could possibly be done to aid in changing a city sky. It was worth the read. ☆



(Mobile, continued from page 58)

tarium and also to present the word and concept of "constellations."

We hope to see even more submissions in 2015 please! Participants must send materials, before December 31. For rules see: www.ips-planetarium.org/?page=portablecom

Share astronomy in Italy

September 15 is the yearly deadline for the applicants of "An Astronomical Experience in Italy for an American Planetarium Operator."

Application Procedure: Send an application that includes your full name, complete address, year of birth, and your curriculum vitae, along with a cover letter explaining why you wish to be considered for this experience.

You must also include the text of three lessons (or variations of the same lesson), with a full description of the activities and copies of the stories, which you would like to present:

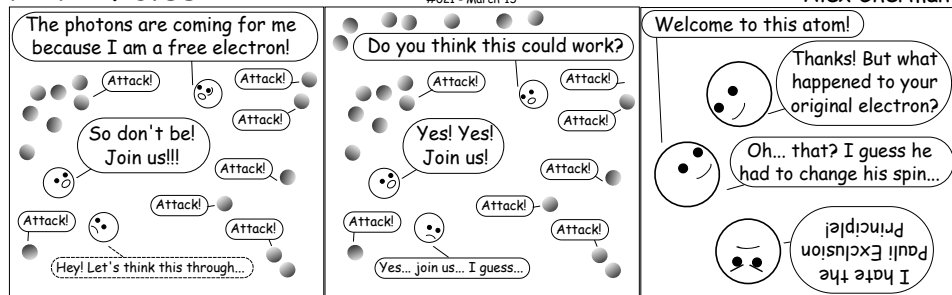
(1) for students, (2) for teachers and (3) for the public.

Please include a list of specialized vocabulary or any other relevant materials that you feel would strengthen your application.

Send your application to:

Loris Ramponi, Osservatorio Serafino Zani,
Via Bosca 24, 25066, Lumezzane, Italy, or
email the material to osservatorio@serafino-zani.it or megrez58@gmail.com. ☆

PARTYcles



(Sound, continued from page 64)

Sound Wave, based on wave field syntheses) deals with sound objects on individual locations in the dome and a enlarged sweet spot area. With this format, this sound object are free to be placed and moved through the dome with an open interface to digital audio workstation (DAW) and external hard and software.

In my next column I'll discuss more surround sound formats, including 3D audio, and interview producers as to how they use the formats. We will answer questions like "How do I create a surround sound track" and "How do I convert my old shows with stereo audio to surround."

Reader question

Q: What is peak power? A: Meaningless. Peak is a number made up by speaker manufacturers who just multiply their RMS rating x4 to get this number, which is only used for marketing. Audio professionals never use "peak power" ratings as they are not a measurable number.

What matters is matching the RMS power a speaker can handle with the RMS power an amplifier can deliver. The amplifier should be rated at 1.5 or 2 times what is needed to generate the SPL (loudness) you want. Why? See my earlier articles about this in the Autumn 2014 issue. ☆

Immersive Theater Expo brings vendors, users together

Bowen Technovation of Indianapolis (Indiana) hosted its first Exhibit and Immersive Theater Expo in October, featuring a dozen different workshops and interaction with representatives from nearly 40 companies that manufacture equipment used by exhibit designers, museums, entertainment venues, domed theaters and planetariums, and more.

This was an expo of component and equipment companies that make the smaller systems that all work together to bring alive a museum, or educational exhibit experience.

While not specifically for those of us who are in classic planetarium and domed theaters, a few of the vendors were names you would recognize as planetarium vendors, who, like Bowen, have a large portion of their client base from exhibit, museum, stage and other non-dome facilities.

For example, I discovered an affordable product and its vendor who

could remedy a display case problem that our planetarium is wrestling with. I also learned some valuable tips from a workshop on "power protection and conditioning" for electronic gear.

I found a vendor and affordable solution for an audio display problem. Perhaps my conversations with that vendor caused him to think: "I wonder if I should be considering how my product could be used in the dome world." ☆

- Alan Parise, Schouweiler Planetarium
Videos of the workshop sessions are available at www.bowentechnovation.com/expo2014.



Jeff Bowen (right) being interviewed by the Indianapolis CBS Affiliate WISH-TV8 during the Expo. Photo courtesy Bowen Technovation.

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Waxing New

An eclectic collection about
planetariums, products and people
Compiled by Sharon Shanks



Andy Bowers with his paper plate project

It all started with the letter M

By Andy Bowers
abowers@bvps.org

I work as an aide in a preschool class with 4- and 5-year olds, as well as being a student at Northeast State Community College in Blountville, Tennessee.

We were learning about the letter M that week and some of the kids saw me working on a class project, so I told them about Neil Armstrong being the first man on the moon and they recognized the “M” sound.

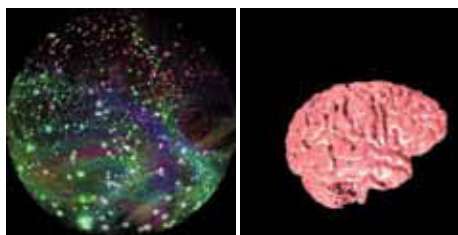
Because it caught their interest and I needed something to add to my project, I came up with the paper plate man on the moon.

I allowed a couple of the students help me, and we painted one side of each paper plate gray (could also color with markers or crayons). I printed off pictures of an American flag and an astronaut to complete it. (Having them draw the flag and person would have been preferable, but to save time I just printed them.)

Then we glued each to a wooden stick (the astronaut being a longer stick or on two put together), and glued the flag on its stick to one plate.

Next we stapled the plates together, and I left a little slot where I could slide the astronaut stick through while he able to move him up and down, as if he was walking on the moon.

In addition to recognizing the letter “M,” the education aspects for the little kids includes color recognition (the grey moon, colors on the flag) and fine motor skills (painting and coloring).



Left: Fiber tracts, myelin-insulated bundles of axons, are shown here as computationally extracted from diffusion tensor imaging data. Right, A view of the surface of the brain, derived from anatomical MRI images. Photos by Neurodome.

Neuroscience under the dome

The planetarium dome can take audiences by their imaginations to galaxies far, far away—and now can take them inside their brains as well.

After six years of development, neuroscientist Jonathan Fisher and his Neurodome team have partnered with the Swedish full-dome theater company SCISS and can now offer the dome market an environment for real and mind-blowing neuroimaging in the Uniview full-dome software.

Fisher is a neuroscientist at New York Medical College in Valhalla, New York, who has a background in astrophysics.

The inspiration for the project sprung from an interest in the human drive to explore, and also telling the story about the neuroscience underlying this drive.

Because of the proven educational merit of immersive display projection, the idea finally crystallized into developing dome-format experiences that allow audiences to explore the brain, utilizing entirely real scientific data.

“Neuroimaging is our spaceship to explore the brain. We can now give presentations and live tours where you travel from intergalactic space, to the solar system, down to Earth, and then end up inside the structures of the brain.”

To make Neurodome possible, Fisher’s team joined forces with SCISS to develop a program

capable of displaying actual three-dimensional biological data in a dome-format film. The SCISS team liked the idea of expanding their presentation sets to a scientific field beyond astronomy, and have therefore mutually helped the development of Neurodome.

In the beginning of 2015, the team will launch a first interactive live-presentation in Uniview called “Neurotours.”

ESA names new Director General

The Council of the European Space Agency announced in December the appointment of Johann-Dietrich Wöerner, current chair of the Executive Board of the DLR, the German Aerospace Center, as the next Director General of ESA, for a period of four years starting on 1 July 2015. He will succeed Jean-Jacques Dordain, whose term of office ends on 30 June 2015.



Mr. Wöerner is currently Chairman of the Executive Board of the DLR, German Aerospace Center.

Wöerner, who has been chair of DLR since 1 March 2007, studied civil engineering at the Technische Universität Berlin and the Technische Hochschule Darmstadt. As part of his studies, he spent two years in Japan investigating earthquake safety. Until 1990 Wöerner worked for the consulting civil engineers König und Heunisch.

In 1990 he returned to Darmstadt University, where he was appointed to a professorship in Civil Engineering and took over as head of the Testing and Research Institute.

Before being elected President of the Technische Universität Darmstadt in 1995, he held the position of dean of the Civil Engineering Faculty. ☆

Chris A. Highlen, 1961-2014

Chris Alan Highlen, 53, of Fort Wayne, Indiana, passed away unexpectedly on October 16, 2014. He was born in Bluffton in 1961, the son of the late James and Joyce Highlen.



Chris Highlen

In addition to serving as the technician at the E. C. Schouweiler Planetarium at the University of St. Francis in Fort Wayne, he was the observatory director for the Fort Wayne Astronomical Society for 25 years, and also a founder of TekVenture and Science Central.

He introduced thousands of adults and children to the glories of the heavens as he guided their viewing through telescopes.

A Celebration of Life Service was held in November in the Achatz Hall of Science at the University of St. Francis. ☆



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2015

International Year of Light

- 15 March. International Day of Planetaria. www.dayofplanetaria.org
- 19-21 March. Themed Entertainment Association, TEA 2015 Summit, Disneyland Resort, Anaheim, California, USA. www.teaconnect.org
- 28 - 30 March. Canadian Association of Science Centres (CASC), Annual Conference, TELUS World of Science, Edmonton, Alberta, Canada. Contact: Ian McLennan, ian@ianmclennan.com, www.canadiansciencecentres.ca/main.htm
- 10-12 April. Italian Association of Planetaria (PlanIt), XXX National Conference, Infiniti To Planetarium, Turin, Italy. www.planetari.org Contact: osservatorio@serafinozani.it
- 13-14 April. Central European Fulldome Festival Brno 2015, Brno Observatory and Planetarium, Kraví hora 1, Brno, Czech Republic. Contact: Jiri Dusek, director@hvezdarna.cz, starrylab.cz/festival
- 1 May-31 October. Expo 2015, "Feeding the planet, energy for life," World Exposition, Milan, Italy. en.expo2015.org
- 1-4 May. Gesellschaft Deutschsprachiger Planetarien e.V., GDP 2015, Annual meeting of Society of German-Speaking Planetariums, Potsdam, Berlin. Contact: Karin Flegel: k.flegel@urania-potsdam.de; www.gdp-planetarium.org
- 7-10 May. Association of French Speaking Planetariums (APLF), Yearly Meeting, Planétarium de Reims, France. Contact: philippe.simonnet@mairie-reims.fr; www.aplf-planetariums.org
- 13-16 May. Middle Atlantic Planetarium Society (MAPS), Annual Conference, Cradle of Aviation Museum/Nassau Community College, Garden City, New York (USA). Contact: Patty Seaton, pxts13@yahoo.com; www.mapsplanetarium.org
- 18 May. International Museums Day, icom.museum
- 27-30 May. 9th FullDome Festival, Jena Zeiss-Planetarium, Jena, Germany. Contact: info@fulldome-festival.de or Volkmar Schorcht, schorcht@zeiss.de, www.fulldome-festival.de
- 11-13 June. European Network of Science Centres and Museums (ECSITE), Annual Conference, "Food for curious minds," MUSE, Trento, Italy. www.ecsite.eu
- 23-27 June. Southeastern Planetarium Association, SEPA 2015 Annual Conference, Tellus Science Museum, Cartersville, Georgia, USA. www.sepadomes.org
- 21-24 July and 27-30 July. Spitz Summer Institute 2015, Chadds Ford (near Philadelphia), Pennsylvania, USA. Planetarium educators' development and training (Beginner/Intermediate and Intermediate/Advanced sessions) for SciDome/Starry Night Dome users, held at Spitz, Inc. facility near Philadelphia. Curriculum, program creation, and presentation for the digital planetarium. www.spitzinc.com/Institute or contact: jtowne@spitzinc.com
- 29 July-2 August. Western Alliance Conference, New Mexico Museum of Natural History & Science, Albuquerque, New Mexico, USA. Contact: Jim Greenhouse, jim.greenhouse@state.nm.us
- 3-14 August. International Astronomical Union, XXIX General Assembly, Hawai'i Convention Center, Honolulu, Hawaii, USA. astronomy2015.org
- 6-15 August. Fiske Fulldome Film Festival, Boulder, Colorado, USA. www.fiskefest.com

- 7-8 August. International Planetarium Society Council meeting at the Planétarium Rio Tinto Alcan/Espace pour la vie in Montréal, Québec, Canada.
- 9-13 August. 42nd International conference and exhibition on computer graphics and interactive techniques, SIGGRAPH 2015, Los Angeles, California, USA. www.siggraph.org
- 12-14 August. Digistar Users Group, DUG 2015 Meeting, Salt Lake City, Utah, USA. Contact: ScottN@es.com
- 4-6 September. Nordic Planetarium Association Biennial Conference, AHHA Science Center, Heureka, The Finnish Science Centre, Helsinki, Finland. www.heureka.fi Contact: Kai Santavuori, kai.santavuori@heureka.fi
- 16-18 September. Live Interactive Planetarium Symposium (LIPS), California Academy of Sciences, San Francisco, California, USA. Contact: Karrie Berglund, karrie@digitaliseducation.com; LIPSymposium.org
- 25-26 September. British Association of Planetaria (BAP), annual meeting, Winchester Science Centre and Planetarium, United Kingdom. Contact: BAP President, Mark Watson, m.watson.bap@gmail.com; www.planetaria.org.uk; bapconference.org.uk
- 14-17 October. Great Lakes Planetarium Association Conference, the 50th anniversary of GLPA, Grand Rapids, Michigan, USA. www.glpaweb.org
- 17-20 October. Association of Science-Technology Centers (ASTC) Annual Conference, Montreal Science Centre, Montreal, Quebec, Canada. www.astc.org
- 11 December. Deadline of the Stratoscript Compendium Ring 2014, a scripting competition open to everybody by LSS-Planetarium. Contact: lionel.ruiz@live.fr; www.lss-planetariums.info/index.php?lang=en&menu=compendium&page=compendium2013
- 31 December. Deadline of the prize "Page of Stars" organized by IPS Portable Planetarium Committee in collaboration with Serafino Zani Astronomical Observatory. The prize rules are available at the IPS Mobile Planetarium Committee web page. Contact: Susan Reynolds Button, sbuttonq2c@gmail.com

2016

- 26-28 May. 10th FullDome Festival in the Jena Zeiss-Planetarium, "Frameless Frenzy," Jena Zeiss-Planetarium, Germany. Grand opening 25 May (in the evening). Contact: info@fulldome-festival.de or Schorcht Volkmar, schorcht@zeiss.de, www.fulldome-festival.de
- 17-18 June. International Planetarium Society Council Meeting, Warsaw, Poland.
- 19-25 June. 23rd International Planetarium Society Conference, Heavens of Copernicus Planetarium, Copernicus Science Center, Warsaw, Poland. Contact: maciej.ligowski@kopernik.org.pl
- 24-27 September. Association of Science-Technology Centers (ASTC) Annual Conference, MOSI, Museum of Science and Industry, Tampa, Florida, USA. www.astc.org

For corrections and new information for the Calendar of Events, please send a message to Loris Ramponi at osservatorio@serafinozani.it More details about several of these upcoming events is included in the International News column in this issue. The most up-to-date information also is available online at the IPS Calendar of Events at www.ips-planetarium.org

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Remembrances From Beijing 2014, and a dome in New York speaks

And the Golden Shaver Award goes to (envelope, please): Scott Niskach, for an encounter during the 2014 Beijing conference.

A gentleman entered Scott's car on the hotel elevator, removed an electric razor from his bag, faced the mirrored back wall of the elevator car, and proceeded to shave his face and part of his head, oblivious of the other people who entered the car at different floors.

I remember hearing a buzzing sound when entering the elevator, and wondering what brand of elevator made that sound. Then I spotted the shaver.

As we exited at the ground floor, Scott said, "Did anything about that strike you as odd? I'm so glad you were in that elevator. No one would have believed me."

Overheard during that conference:

At lunch at the Nikko: "This tastes like orange Fanta. Maybe it's Tang."

In the planetarium during the IPS-MSCL Awards: "Oh. Fulldome. I thought they said Fooddome."

Dr. Nikolay N. Samus described the discovery of the 1885 supernova in M31. Ernst Hartwig of the Dorpat Observatory in Estonia was showing a visitor around the observatory

in August of that year, and invited her to view the Andromeda galaxy through the telescope.

When she asked about the bright dot, he recognized the significance of the supernova and sent out notification, by telegram, letter and postcard. The letter was stolen from the post box on the steamer ship delivering the mail, and never arrived.

In 1941, he said, a team of astronomers from Leningrad and Moscow traveled to Kazakhstan to observe a solar eclipse. The war blocked them from returning home, so they stayed and founded the Alta-Ama Astronomical Institute. When the universe gives you lemons...

Describing his institute's masters program: "Training a master of science in astronomy leaves one a couple of years to make an astronomer from a physicist. Not enough."

Ian McLennan served as moderator for one of the paper sessions, which included Francine Jackson's paper "The Train Wreck that Changed Time." He observed, "I've always wanted to introduce a train wreck."

During the MAPS meeting last September, our hosts at the Maryland Science Center were demonstrating some effects they've developed with the Davis Planetarium's full-dome system. The entire dome was covered with numbers, specifically the first ten thousand digits for pi. Einstein's birthday is March 14 (3/14 for us North Americans) and the Science Center usually has a big celebration. Recitations of pi, pi tee shirts, even pie.

That was followed by one of their customizable offers. If you'd like to propose marriage to your sweetheart under the stars, their clever staff has developed a moving field of stars that resolves itself into the words, "Will you marry me?"

At that point in the demonstration, a tearful voice from the back of the theater called out, "Yes!" to which Wendy Ackerman replied, "Finally!"

Frank Summers began his "Exploding Universe: From Destruction Comes New Creation" presentation with a check of the sound system. Gesturing to Steve Burr toward the back of the theater, he asked, "Is this microphone on? Steve?" To which Steve replied, "EEEEEEEE!" (imitating feedback, presumably).

After hearing about the project, Mike Mur-

ray commented, "It's *Jaws* in space!"

Amy Gallagher shared her planetarium's foray into guided meditation. It's offered for the college campus staff and students, and provides a quieting experience to frazzled attendees. The woman who does the guiding is, as Amy puts it, "the one who makes sure everyone gets back into their bodies."

Voices from above

Carter Emmert delivered the Margaret Noble address for the conference banquet. He's a great story teller.

Carter described sharing virtual space with colleagues. He was in the dome in New York and they were in Illinois. With the connection they were using, each person had an "avatar" that appeared on the dome in the other location. Carter could talk with Donna Cox (director of the Advanced Visualization Lab at the National Center for Supercomputing Applications in Champaign; see page x), and their avatars could "see" each other.

Dave was one of the guards at the planetarium. He was really interested in astronomy, and Carter had taught him to "fly through the stars" with the star projector and console controls. The two of them had many long conversations about heaven and the universe.

A few months after the virtual space project was underway, Carter was in the dome working one evening, and Dave came in.

"Who's in the dome?" he asked.

"Dave, it's Carter."

"Yeah, but who else is in here? I hear voices."

At this point, Donna's avatar on the dome turns toward Dave, waves, and says, "Hi, Dave!"

The door slammed behind Dave as he sprinted from the theater.

Concerned, Carter followed, to find Dave huddled in the hallway muttering to himself. When Carter explained he was working on a project, Dave exclaimed, "I know you're working, and we've talked about heaven and stuff, but now you're talking to people up there."

What is your earliest memory? Many of us have memory "snapshots" from our childhoods, some event that we remember: a particular birthday celebration, the first day of school perhaps, or someone pointing out something in the sky. I think I was about 4 years old when my father pointed out Venus in the evening sky, and told me it was a planet.

A phone caller to the science center described seeing Sputnik in 1957. His father had taken him and his brother, ages 7 and 9 at the time, into the backyard.

"People were afraid when Sputnik was launched," the caller said. "The satellite was visible before dawn and after sunset. My father said, 'See that? That's what happens when really smart people work together really hard for a long time.'"

Rather like planetarium work, isn't it? ☆



The launch of Orion EFT-1 (Exploration Flight Test) aboard a Delta IV Heavy from the NASA Causeway Press Viewing Site, December 5, 2014. This was the first test flight of NASA's Orion Multi-Purpose Crew Vehicle. Photo by: George Fleenor, GeoGraphics Imaging



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